

ARCHIVES

Towards the Anthropocene.

Colossal Naturality in Disordered Territories

by

Sasa Zivkovic

SUBMITTED TO THE DEPARTMENT OF ARCHITECTURE IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARCHITECTURE AT THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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Towards the Anthropocene .

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Towards the Anthropocene.

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ON JUNE 29, 2012
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ARCHITECTURE

ABSTRACT

"A controversial new development has recently been put up for debate within the discipline of Geology: Do current levels of human interaction in Earth's geology and atmosphere justify the proclamation of a new geological age or era: The Anthropocene?"

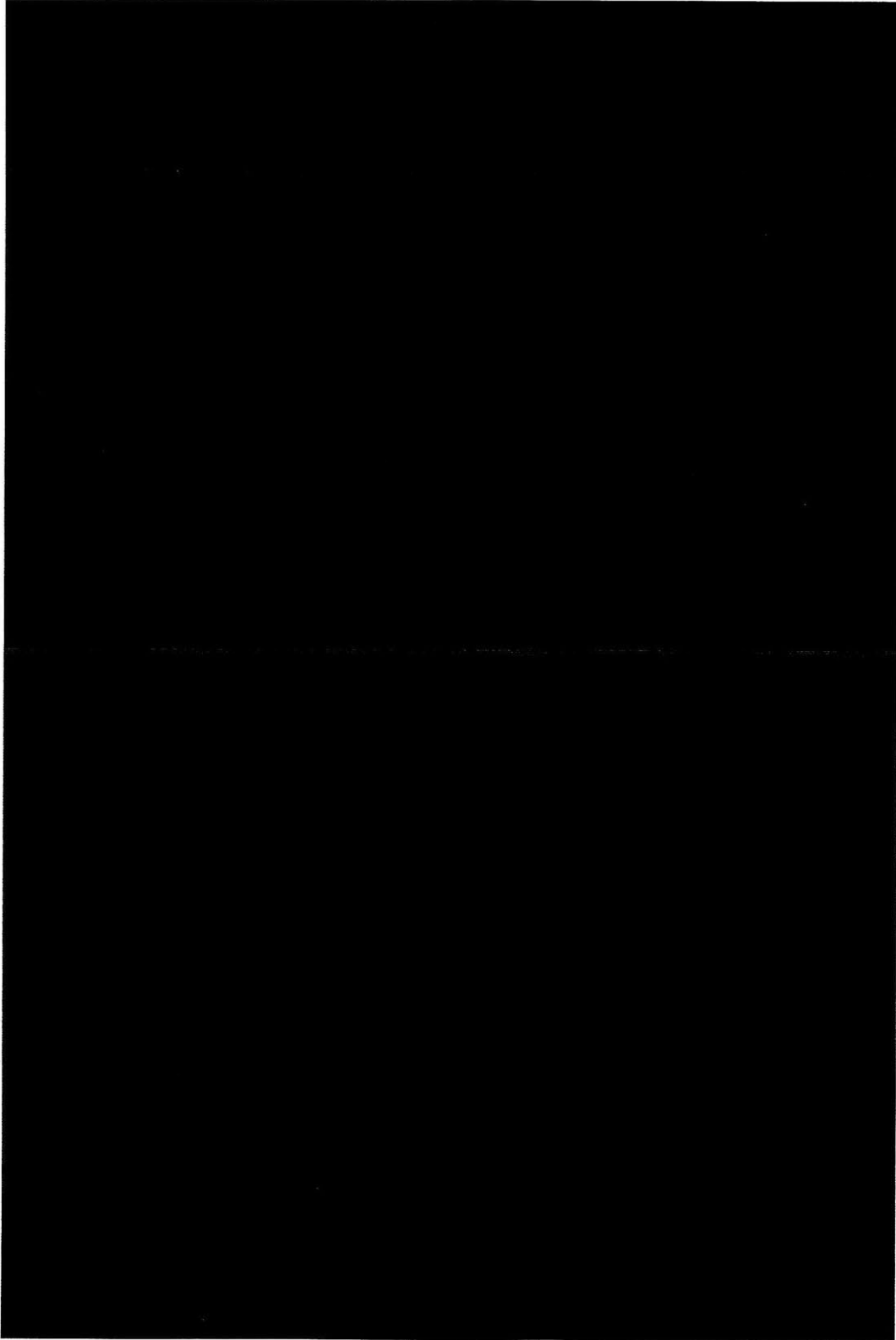
Entering a realm of scientific uncertainty and discourse, this thesis argues that the conceptualization of the Anthropocene (as a product of human ubiquity) yields the premise to summarize and critique a whole number of recent influential paradigm shifts and theoretical frameworks in architecture, which, in essence, address the relationship between the "man-made" and the "natural".

The main hypothesis of this thesis is based on the assumption that principles of dirt and contamination (states of disorder) will replace principles of natural preservation and mythical naturality (seemingly ordered states) as the new primary vessel of meaning for the production of Anthropocene environment, architecture, ecology, society and culture.

The Chernobyl Exclusion Zone will serve as a case study for investigating the Anthropocene condition."

Thesis Supervisor: William O'Brien, Jr.
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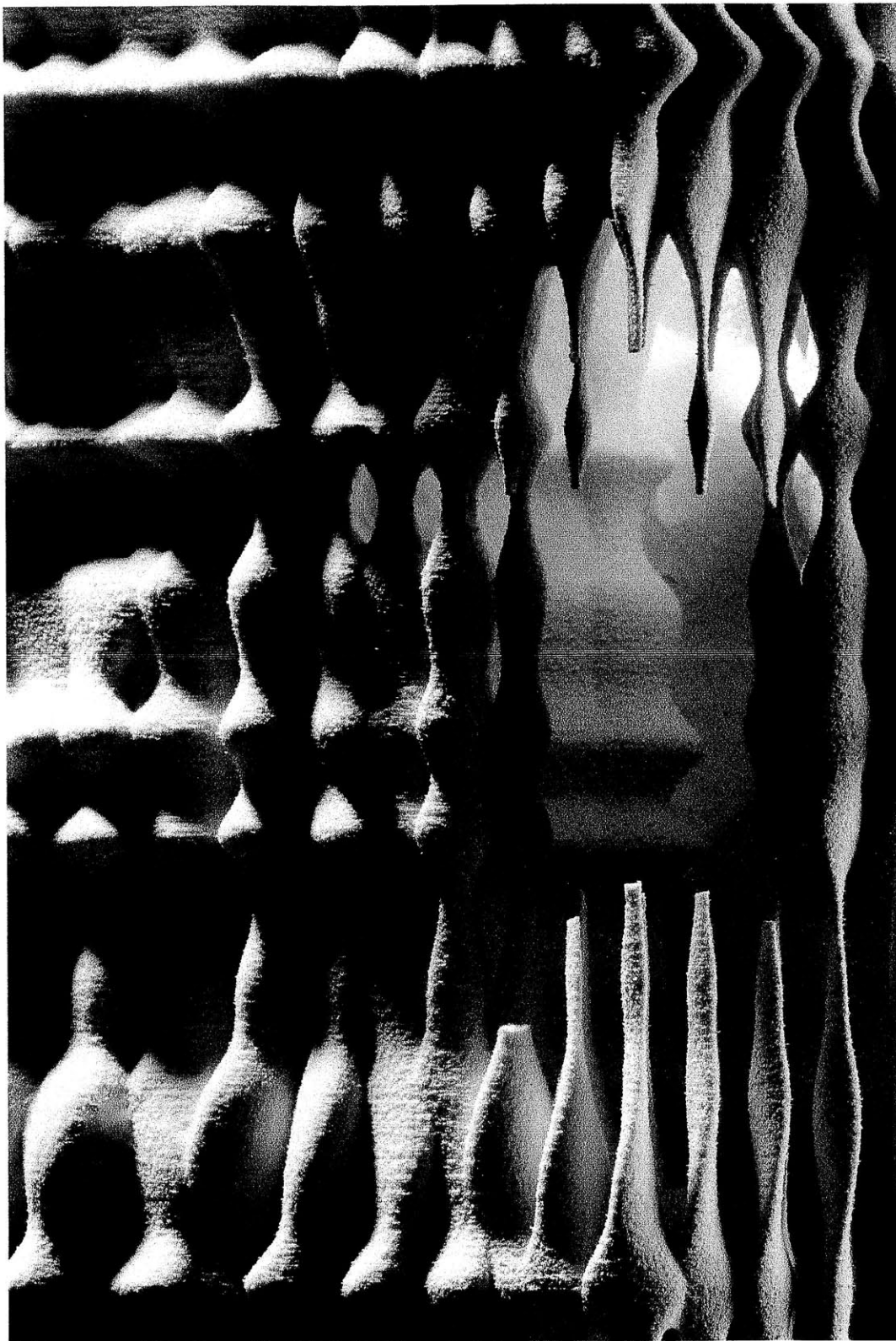
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Thank You



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Thank You

Thank You .
in no particular order

THESIS TEAM

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SUPPORTERS

Thank you, Studienstiftung des deutschen Volkes, DAAD, Sutor-Stiftung and MIT's Department of Architecture for all the financial support during four years of study.

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Ohne Dich waere ich hier nicht gelandet. Vielen Dank fuer die Qualen!

MEINE FAMILIE

Vielen Dank, Freunde (Grosse und Kleine). Ohne Euch haette das schon gar nicht geklappt! Ihr habt mich immer unterstuezt. Vielen, vielen Dank!

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FOR
Waikai

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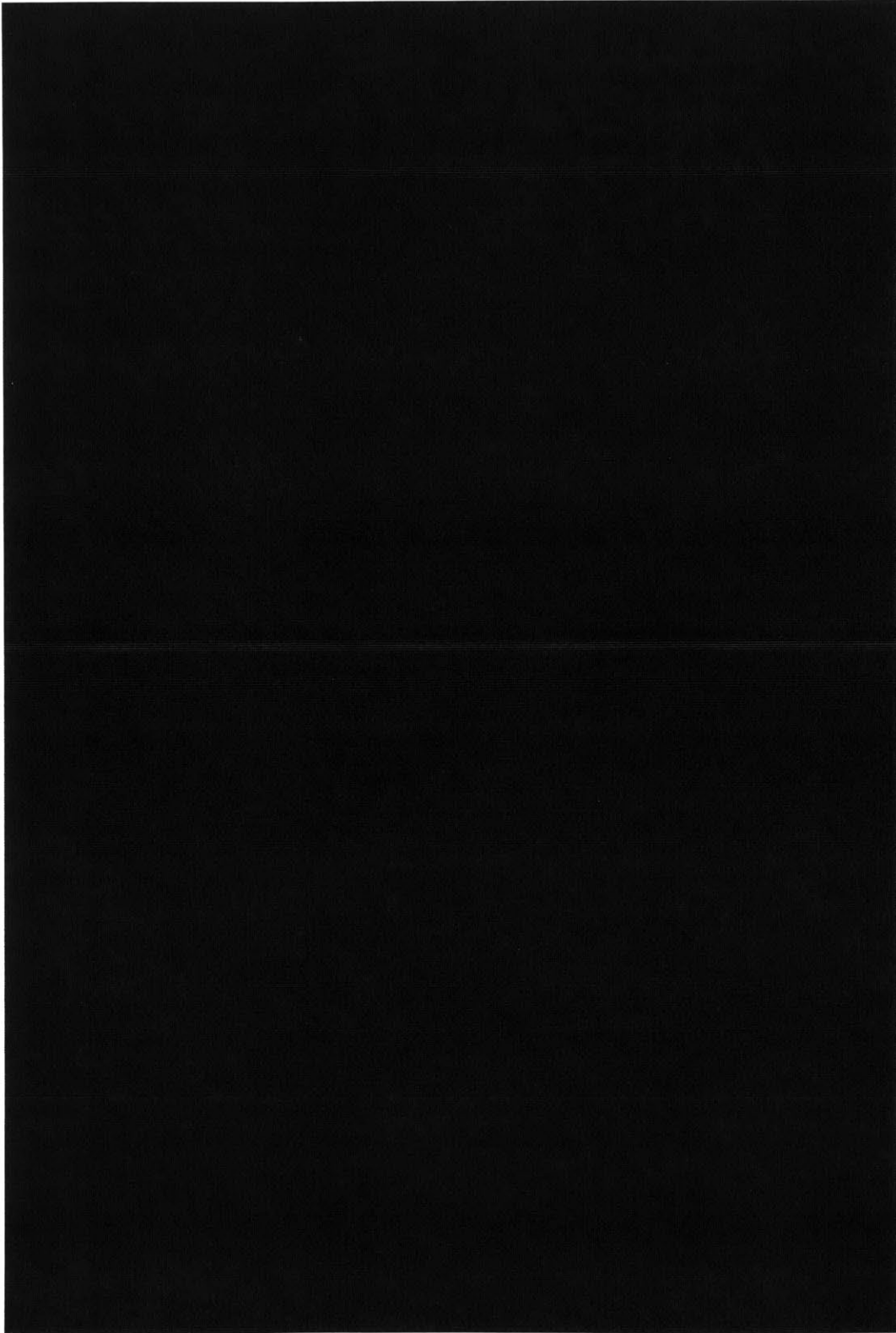
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Chapter 01

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PRESENTATION

Board 01

“Geologists are divided by disagreement: Do current levels of human interaction in Earth’s geology justify the proclamation of a new geological age or era: The Anthropocene?”

Entering a realm of scientific uncertainty and discourse, this thesis argues that the conceptualization of the Anthropocene (as a product of human ubiquity) yields the premise to summarize and critique a whole number of recent influential paradigm shifts and theoretical frameworks in architecture, which, in essence, address the relationship between the “man-made” and the “natural”. On a broader scale this debate includes, but is not limited to, contemporary turn(s) towards biology, cybernetics, chemistry, nature, sustainability, meteorology, environment and ecology. Not all of those are the interest of this thesis project – but the Anthropocene as a meta-concept is a quite broad idea.

The main hypothesis of this thesis is based on the assumption that principles of dirt and contamination (states of disorder) will replace principles of natural preservation and mythical naturality (seemingly ordered states) as the new primary vessel of meaning for the production of anthropocene environment, architecture, ecology, society and culture.

What do I mean with that?

Everything I just said is not a new development per se: First, the Anthropocene itself is a retroactive condition. Experts’ opinions on the beginnings of the Anthropocene vary from the Industrial Revolution to the Agricultural Revolution – or everything in between. Second, we are already living in a world of pollution, hybrids, wastelands, third landscapes and human ubiquity. Various thinkers have declared the “death of nature”, by questioning the myth of purity and harmony which surrounds this expression. As Latour puts it : we live in a world of hybrids and collectives where every whale is equipped with a GPS system – which is then attached to a researcher – who belongs to a university – which is located in a state or territory, etc. We have hybrid corn, cloned sheep, killer germs, etc. etc. There is nothing pure about nature. “

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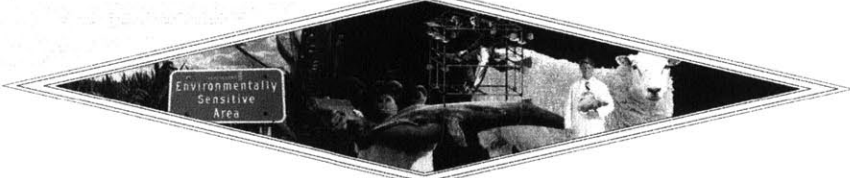
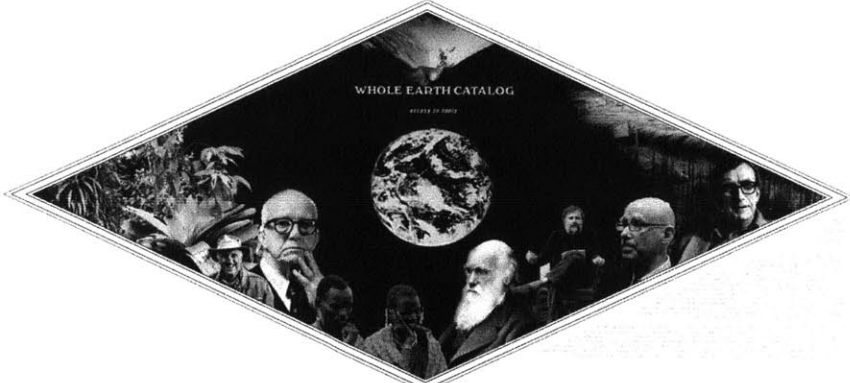


Board 02

"The myth, that somewhere on this planet one can find a untouched, clean piece of nature (capital N) is nevertheless still hovering around. The idea that nature is balanced and harmonious is a remnant of ideas we have leave behind: For example: Buckminster Fuller's and Stewart Brand's excitement about the picture of the Whole Earth. The anthropocene "Whole Earth" is a giant sphere surrounded by enormous amounts of space trash, telescopes, satellites, astronauts.

I think, the Anthropocene is as much an inventory as it is an agenda. It raises the following question: If we have reached Terra Anthropocena - if not even Geology is "natural", if everything is produced by humans, if there is no nature, if the myth has finally died: what do we relate to? If nothing can be taken for granted, where does Nature begin? If we produce our own weather, climate, oceans, biodiversity, forests, deserts, cities, wastelands – in turn, how do those things produce architecture? If this sort of cyclical ephemerality seemed grand in the Holocene – it is now colossal in the Anthropocene. Everything is a nature-culture collective."

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Board 03

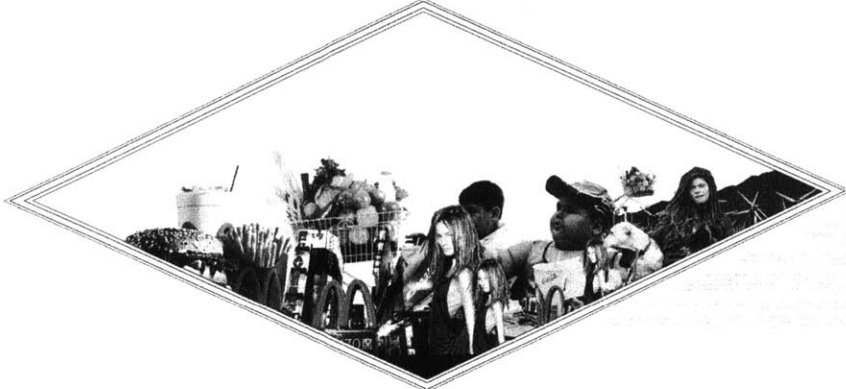
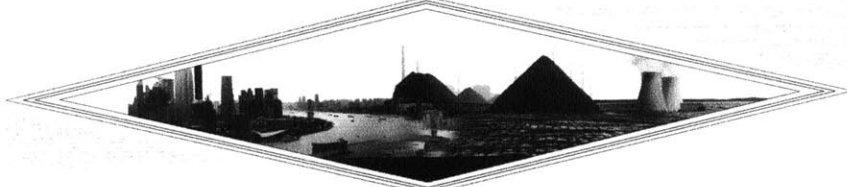
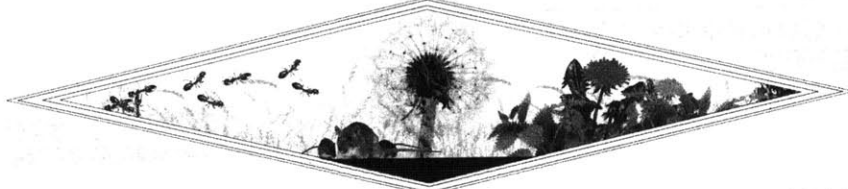
"In order to better understand the Anthropocene one has to look at pollution, contamination and toxicity. I think this is where the paradigm shift happens away from "mythical natures" towards anthropocene territories. Notably since the Industrial revolution, toxicity has become a "natural" part of our environment. Ulrich Beck has described the broader social implications of toxicity by saying that: "poverty is hierarchic, whereas smog is democratic". Dust covers queens, factory workers, prime ministers, bums, presidents, prostitutes, movie stars and dictators. The Anthropocene is potentially a democratic territory.

Stanford Kwinter states that " ideas of contamination are, by all accounts, endemic to human societies since their earliest beginnings." "Dirt is a disorder that threatens an existing or emerging pattern, a formlessness that threatens form." Ideas of contamination have an impact on culture as well as nature; on architectural organizations as well as socio-political orders.

In Architecture, we are mostly only reacting to what I think is somewhat of a Super-Ego in the sense of Freud: 2 degree climate goals, sea level rise, co2, desertification, LEED, deforestation. Those are the things that should not be and therefore one needs to solve them. The concept behind the problem remains unchallenged.

But in my mind the potential of those super-egos is very interesting when approached from another angle: Contamination de-territorializes existing orders and organizations – it is "matter out of place" - in my mind it is how we can begin to relate to the Anthropocene. In this sense undesired things happen at all scales: plants and animals, landscapes objects and even "cultures."

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Board 04

"For this thesis I was looking for a place where all the above issues collide. Of all the messed up places in the world, Chernobyl is a prime candidate for exploring the Anthropocene condition.

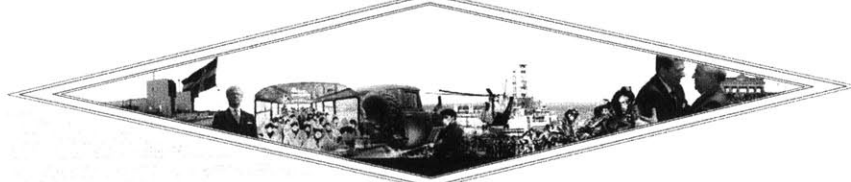
The city of Pripyat was founded in 1970 as one of the soviet nuclear model cities – a so called Atomograd. It is the first Soviet city built after the model of triangular city planning – which means that the housing blocks are arranged in triangular shapes- maximizing open green space within higher density living situations. At the time of the accident the city of Pripyat had about 50000 inhabitants.

The Chernobyl accident was named after an old village nearby the reactor – the actual power plant which caused the catastrophe is located in the city of Pripyat. On April 26 1986, reactor block 4 had a meltdown due to a safety experiment which caused an explosion that triggered the catastrophe. This led to an enormous exodus of people and material out of an initial 30 km exclusion zone. Up until today, over 300000 people had to relocate in surrounding regions.

The catastrophe caused enormous social problems from thyroid cancer to prostitution and poverty in the surrounding regions. What has harmed the humans seemingly helped the animal and plant population: there is a reverse exodus happening into the zone – what one would call 'Nature' is now blossoming in the Exclusion Zone. One could say that the Chernobyl Exclusion zone will be the most natural place in Europe 300 years from now.

Soon after the accident a new species of inhabitants occurred in the zone. The Stalkers. On the one side there are the locals who are going into the zone to hunt and gather food – and about 15 years after the accident first tourists became interested in a sort of catastrophe tourism and the territory that nature is slowly reclaiming. The need for a tourism infrastructure serves as an architectural entry point to develop an infrastructural framework for anthropocene remediation strategies."

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Board 05

"The impact of contamination is caused by Chernobyl is vast: The toxic cloud travelled across the globe (on the northern half). The majority of contamination happened in Europe. In Germany, for example, one cannot eat wild mushrooms and boar and deer due to the Chernobyl catastrophe and fallout cloud – over 25 years after the accident.

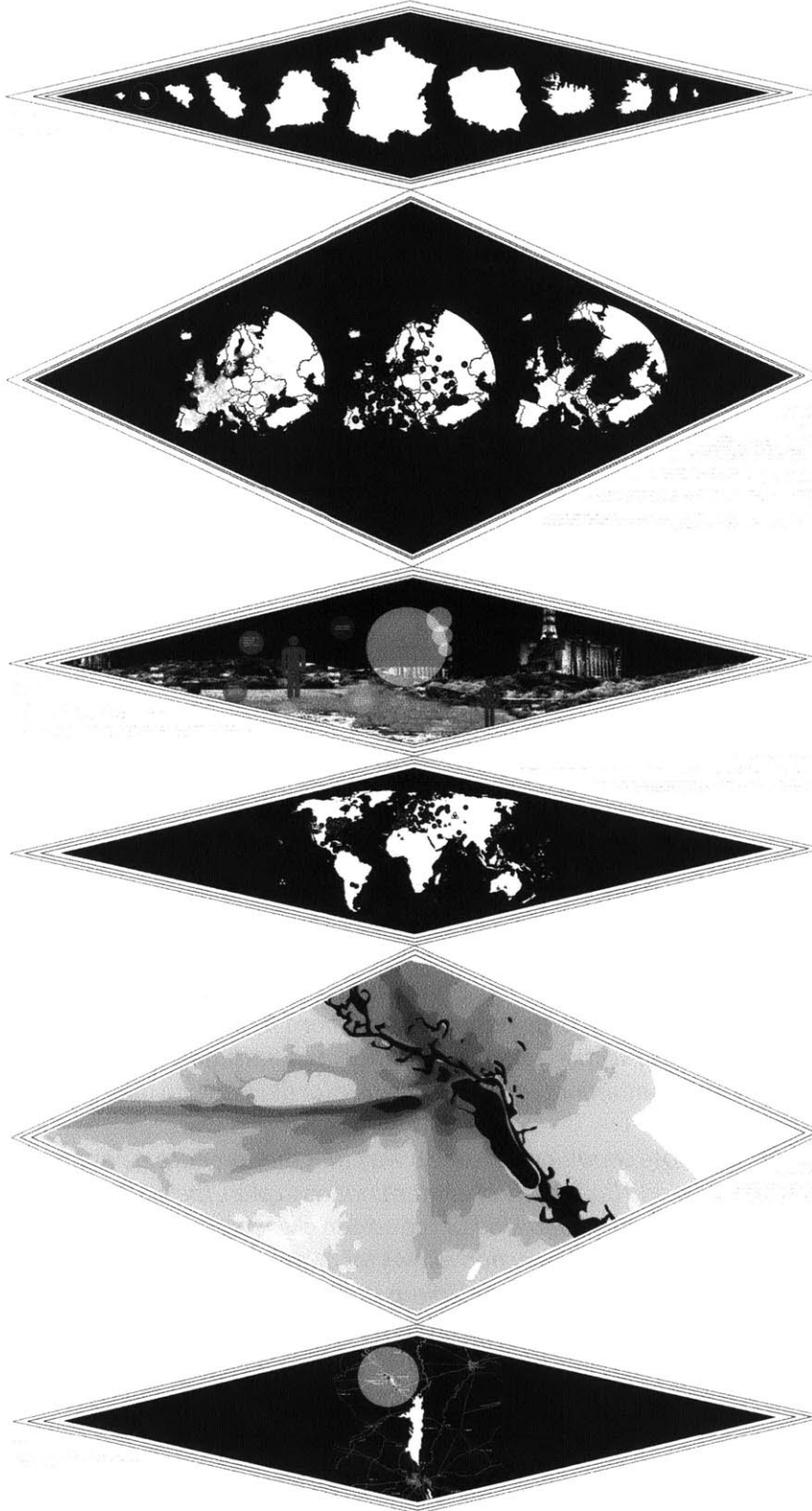
If one were to speculate that all nuclear power plants in Europe produce exclusion zones - the map of Europe would have to be redrawn. It might seem a little cynical to say – but Fukushima has showed that the current rate of nuclear catastrophes is currently about one accident every 25 years. This rate is likely to increase as more and more nuclear power plants get built – as environmentally friendly alternatives to coal and gas.

The current shape of the Chernobyl Exclusion Zone changed from a 30km radius to a figure that is related to soil contamination levels on the site. This means that the current exclusion zone is about 4 times as large as the initial circle.

Drawing 5 shows contamination patterns around the reactor whereas the physical site model shows the Ukrainian side of the exclusion zone. Within European standards, the CEZ might as well be a little state on it's own. It is interesting to remark that the border between Belarus and Ukraine is being maintained and strictly enforced within the wasteland.

Chernobyl is located about 100 km North of Kiev – half of the water within the Kiev reservoir flows through the zone before it reaches the city. Ultimately, there is no escaping Chernobyl."

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Board 06

"What I was interested in is to somehow relate a set of architectural interventions to the site and the effects produced by pollution. I am proposing a set of five programs which all try to capture the absurdity of the site and situation.

One of those interventions is to further develop the tourism infrastructure within the zone with a tourism hotel. The IAEA is interested in a research station on the site and has also proposed to revitalize the zone with industrial production facilities within less contaminated areas. I am also adding an anthropology institute which is supposed to study the Anthropocene within the context of Chernobyl. And there will be an animal decontamination tower which allows animals access to clean water, food and shelter. All of these will be part of a larger connected tourism infrastructure.

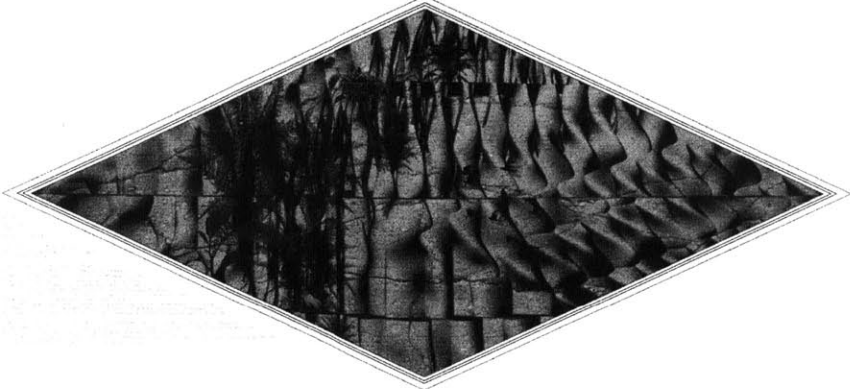
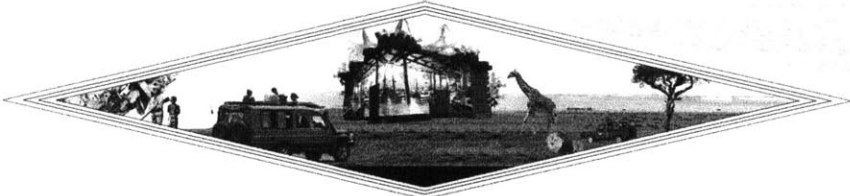
The question becomes: How to place man-made objects into such a hybrid man-made/natural condition? How could one start to relate to all of the above? (This question can be extended far beyond the CEZ. In a way every project in Europe could address the same site specific issues.)

My interest was in creating hybrid buildings that allow for static as well as emergent systems to occur within one program. (static referencing a longer cultural background and history – emergent talking about natural systems and conditions with faster life cycles)

A study of the site led to an interesting discovery within the plan and section of pollution within the site. Given the scale of a building one can say that contamination in plan is ubiquitous and uniform – only very large territorial conditions lead to some kind of figural arrangement in plan. Yet, the section allows for variation; as the higher one goes, the less the environment is contaminated (this is also true for digging into the ground).

I decided to calibrate those conditions in such a way that they produce a nature-culture hybrid. Due to the ubiquity and uniformity of contamination in plan, the buildings are symmetrical and self contained, producing a kind of Ledouxian civic monument to contamination. A second system of organization in section allows for a calibration and gradient change as well as emergent systems to occur as the buildings grow higher. The second system produces layer of naturalness that inhabits those civic monuments."

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Board 07

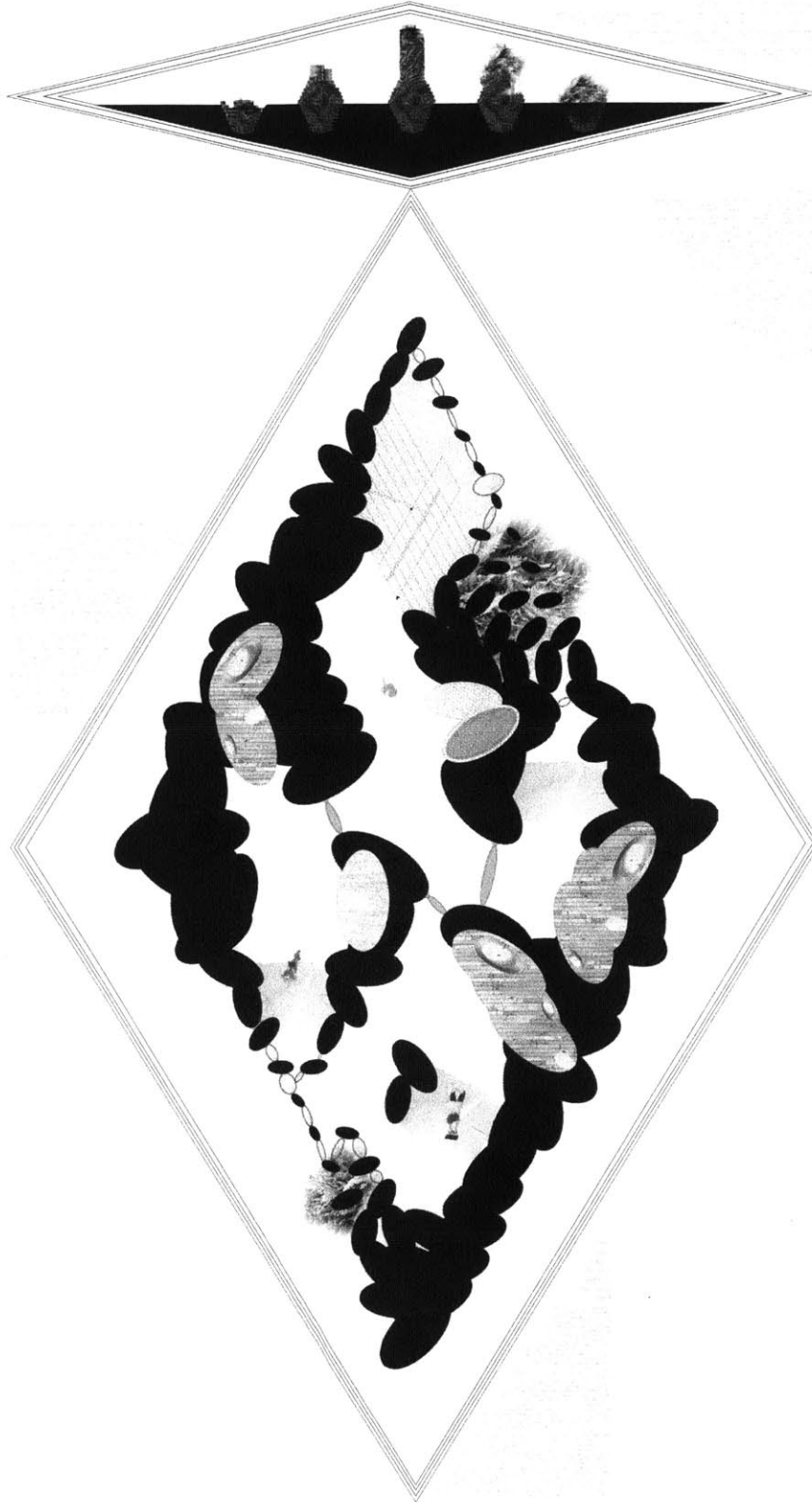
"The hotel tower serves as a permanent infrastructural monument to tourism. The common programs are organized around the ground floor and lobby. This is where the wall thickness is the thickest to shield from radiation effects. The plan of a sample ground floor is cut higher in the building where porosity occurs at certain places. These places are occupied and encroached by vegetation and potentially animals and serve as protected enclaves within the harsh reality of the toxic Exclusion Zone.

The buildings are supposed to start to deteriorate as soon as they are getting built. The upper diagram shows a 500 year timeline of decay and encroachment. All buildings are conceived as ruins. They attempt to somehow relate to the enormosity of nuclear pollution in regards to a human lifespan.

The sample plan on the right shows an upper hotel floor and the organization within the building. Fire stair and elevator are fixed in their location whereas all the other elements vary and respond to a global organizational scheme of the building. The bathroom areas are carved into the thickness of the walls. The interior space has a cave-like feel to it - mixed with a bunker-like feeling of protection due to the extreme thickness of the walls.

Overall, one cannot neglect the fact that the plan has a strange baroque quality which is undermined by the more emergent systems of organizations that occur within it."

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Board 08

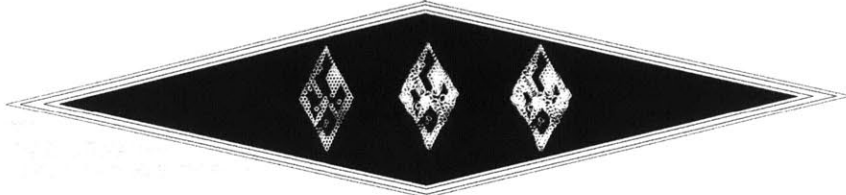
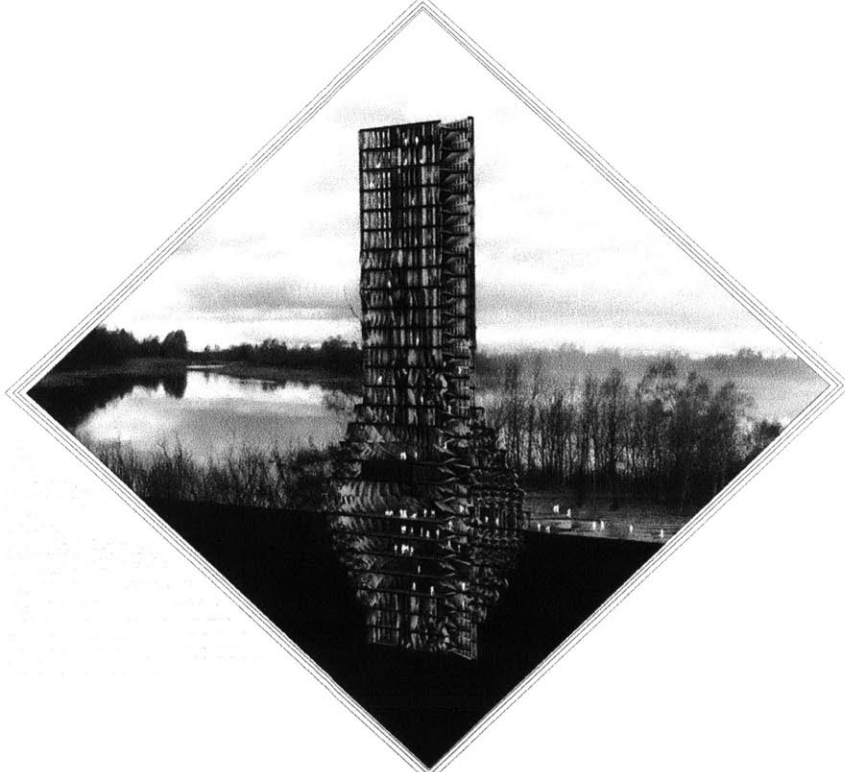
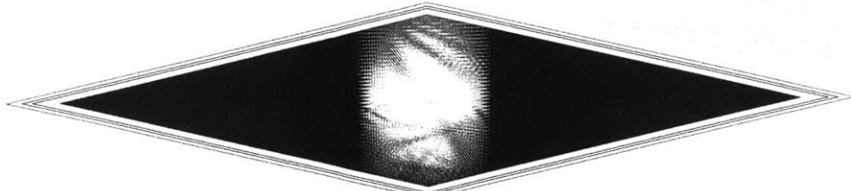
"The first diagram describes the varying intensity and distribution of contamination in relation to the building scale. In plan, contamination is ubiquitous and equally distributed whereas the section allows for a transformation off of the ground.

The lobby of the hotel is a large double story meeting space with a feeling of complete enclosure and protection. This is necessary because the lobby is located on the ground floor level which is in direct contact to radioactive dust and ground radiation.

The section shows the general organization of the hotel: The top floors are used for hotel guests, the floors close to the ground are used as common programs such as a swimming pool, dining, lobby and leisure activities. The floors below ground are protected quarters for hotel staff.

The bottom diagram shows the variability of wall thicknesses within the system. Varying degrees of thickness create different spatial configurations and opportunities. The result is a high variability in floor configurations."

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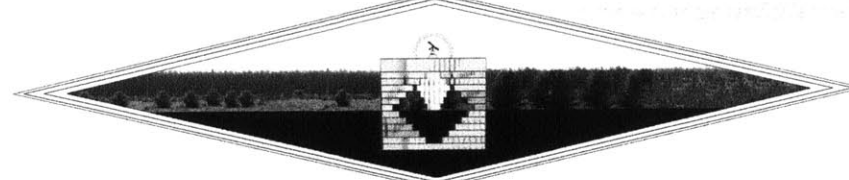
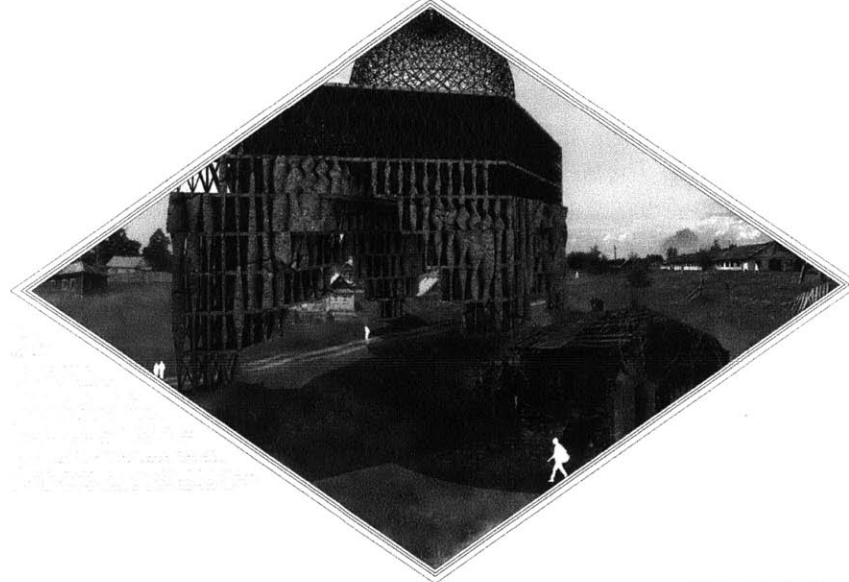
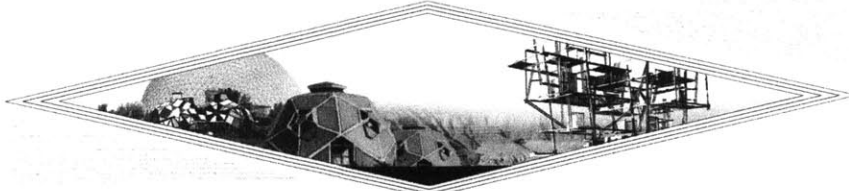
Board 09

"The Anthropology institute references architectural precedents such as the Drop City movement or Constant's New Babylon. Spatially, it utilizes the duality of scaffolding and wall systems to allow for varying degrees of flexibility within the organization of the architecture. The top floors are characterized by high degrees of flexibility - the space is a product of the scaffolding structure.

The entire building is lifted off the ground and floats above the abandoned village of Chernobyl - relating to early modern precedents of "liberated architecture". The degree of liberty is supposed to serve the operational structure of the Anthropology Institute: Spaces can be rearranged according to programmatic needs of the inhabitants.

The very top of the building contains a space telescope which is supposed to monitor and map orbiting space trash - revealing an expansion of humankind beyond the limits of what we conceive as our immediate environment"

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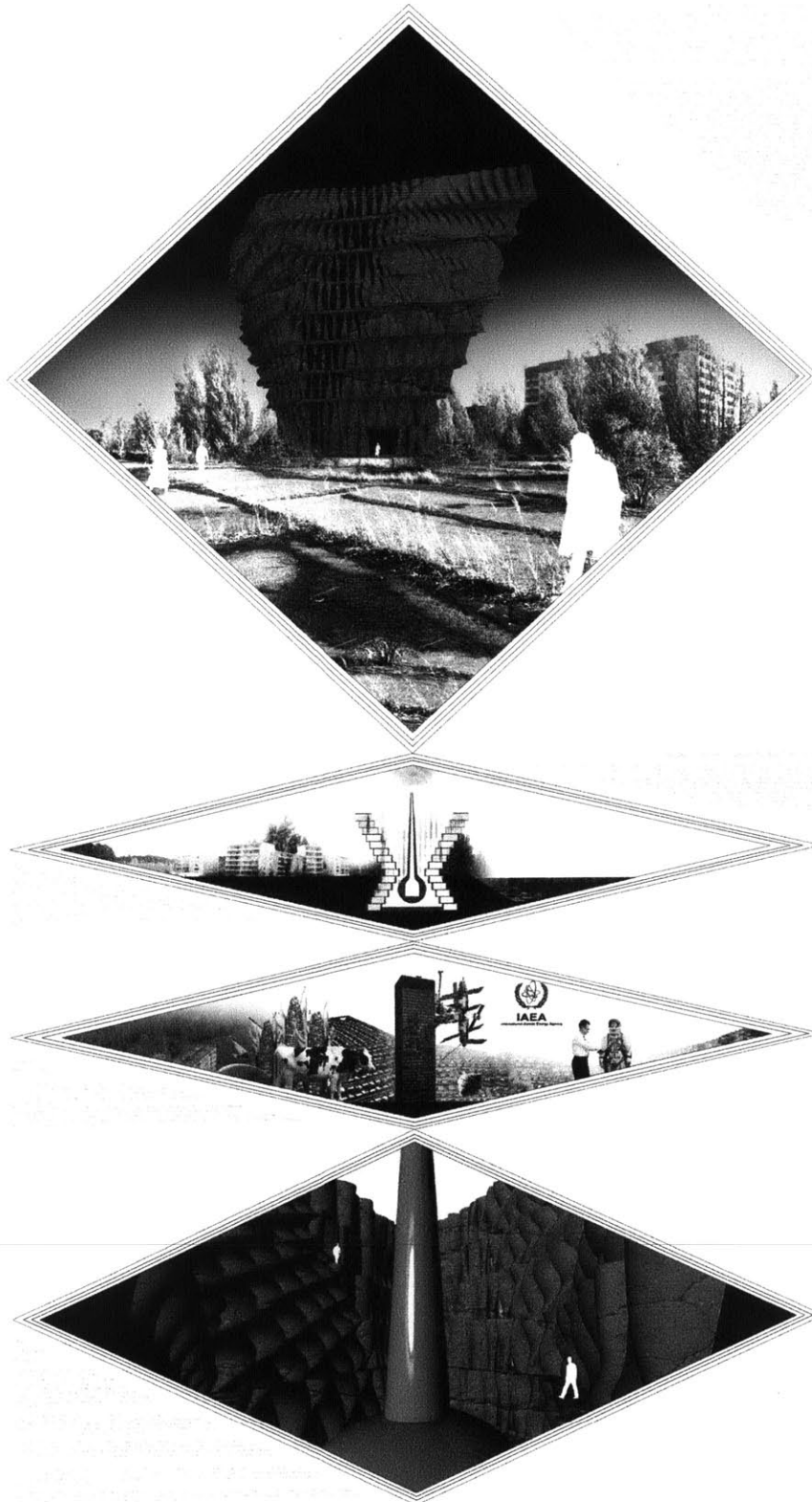
Board 10

"The International Atomic Energy Agency building is located in the abandoned city of Pripyat at the former Hotel plaza. The IAEA research station is supposed to prepare future generations for future Exclusion Zones around the world. Those might serve other Exclusion Zones which are not necessarily related to nuclear contamination.

The IAEA research station is supposed to work on proposing remediation strategies for the Chernobyl Exclusion Zone. It is an institution that can map and monitor radiation development within the zone.

The research station will contain a small nuclear test reactor within its courtyard for further experimentation with nuclear power and its future development."

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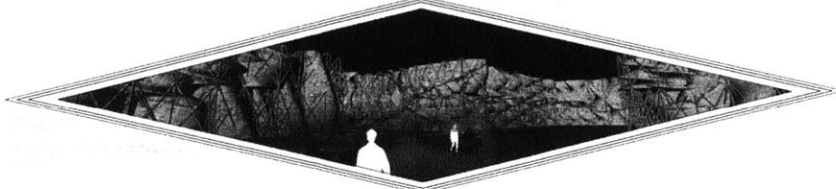
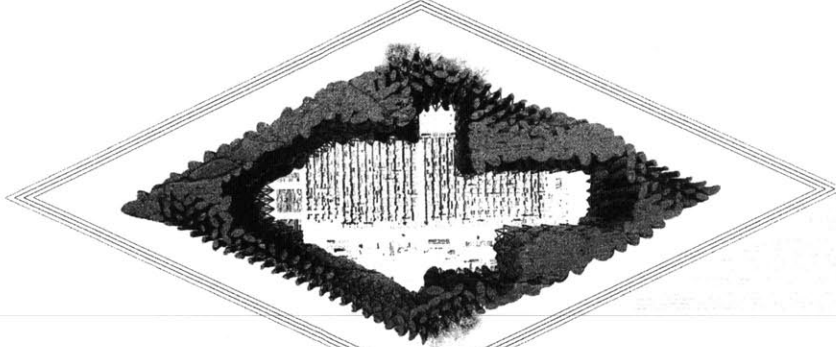
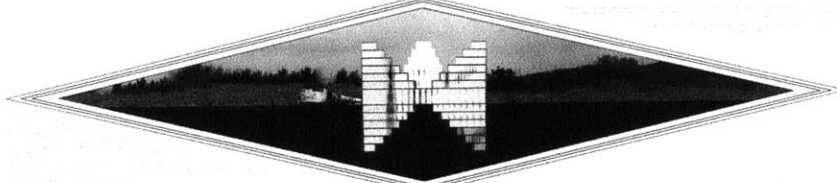
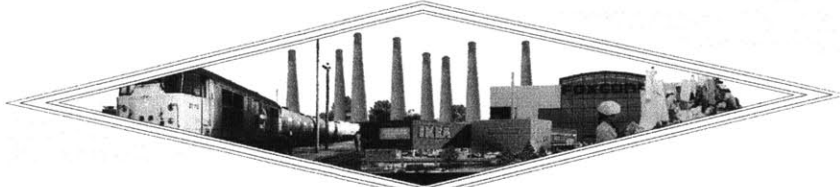
Board 11

"The International Atomic Energy Agency has proposed that certain areas within the Chernobyl Exclusion Zone can be used for industry purposes. Industrial facilities can be located along the abandoned railroad track. This important piece of infrastructure within the Exclusion Zone can help to develop a transportation system and network for produced goods as well as a transportation device for people and materials into the zone from neighboring regions.

The industry buildings provide protected areas for workers within infrastructural towers that are part of each factory hall. This ensures the safety and health of workers within the Chernobyl Exclusion Zone.

The infrastructural towers are the anthropocene pendant to 19th century factory chimneys."

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Board 12

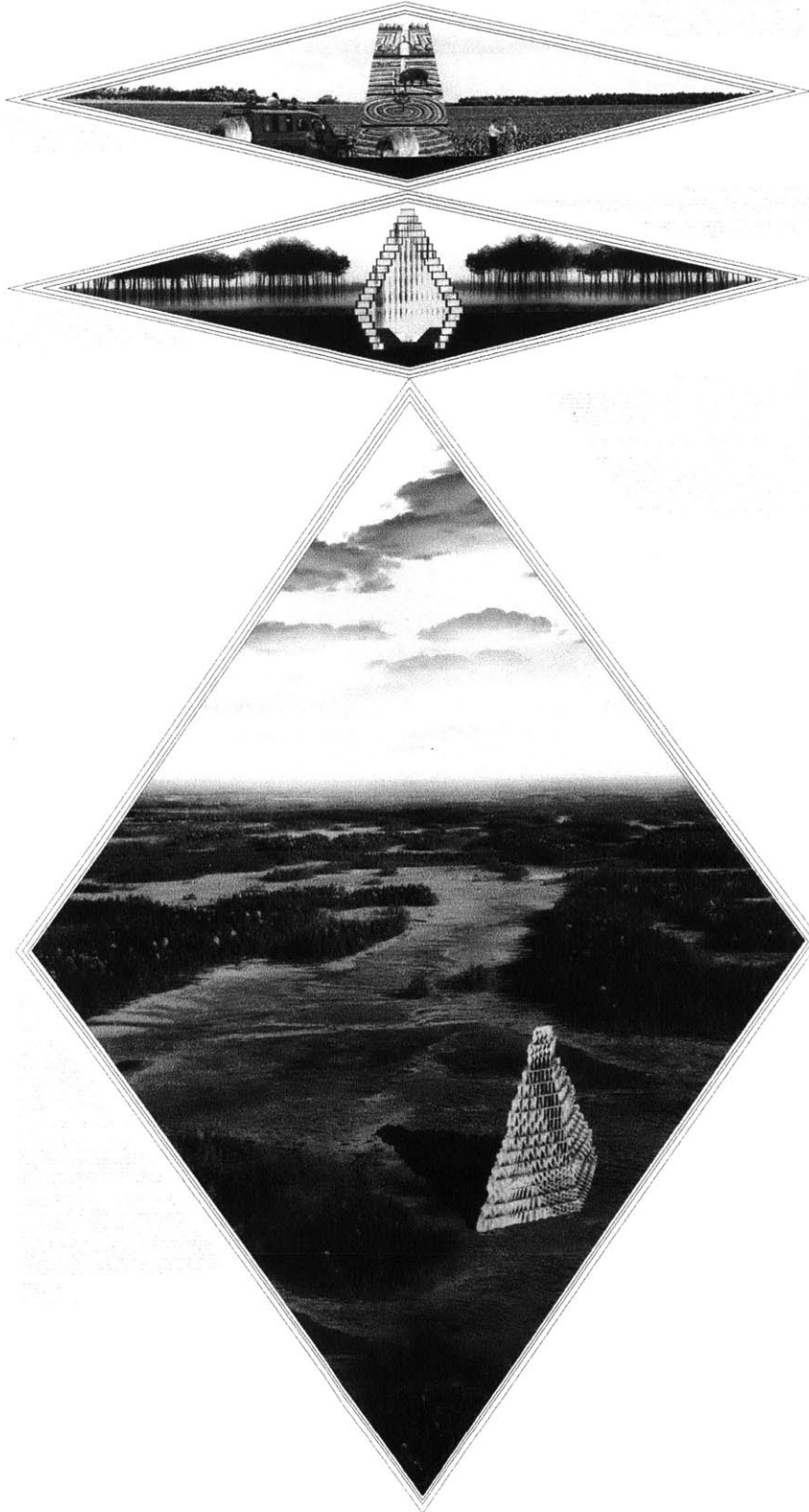
"The Animal Decontamination Tower establishes a moral 'counterweight' to the other proposed programs: It enables animals access to clean water, food and resting places within the structure.

At the same time it functions what one could call an anthropocene zoo: Visitors and tourists will be allowed to enter the structure as observers. The tower allows for an absurd spectacle of observation. It is an unnecessary piece of infrastructure that is absolutely essential to capturing some of the inherent problems of the Chernobyl Exclusion Zone. It is neither man-made nor natural. It is a piece of anthropocene architecture.

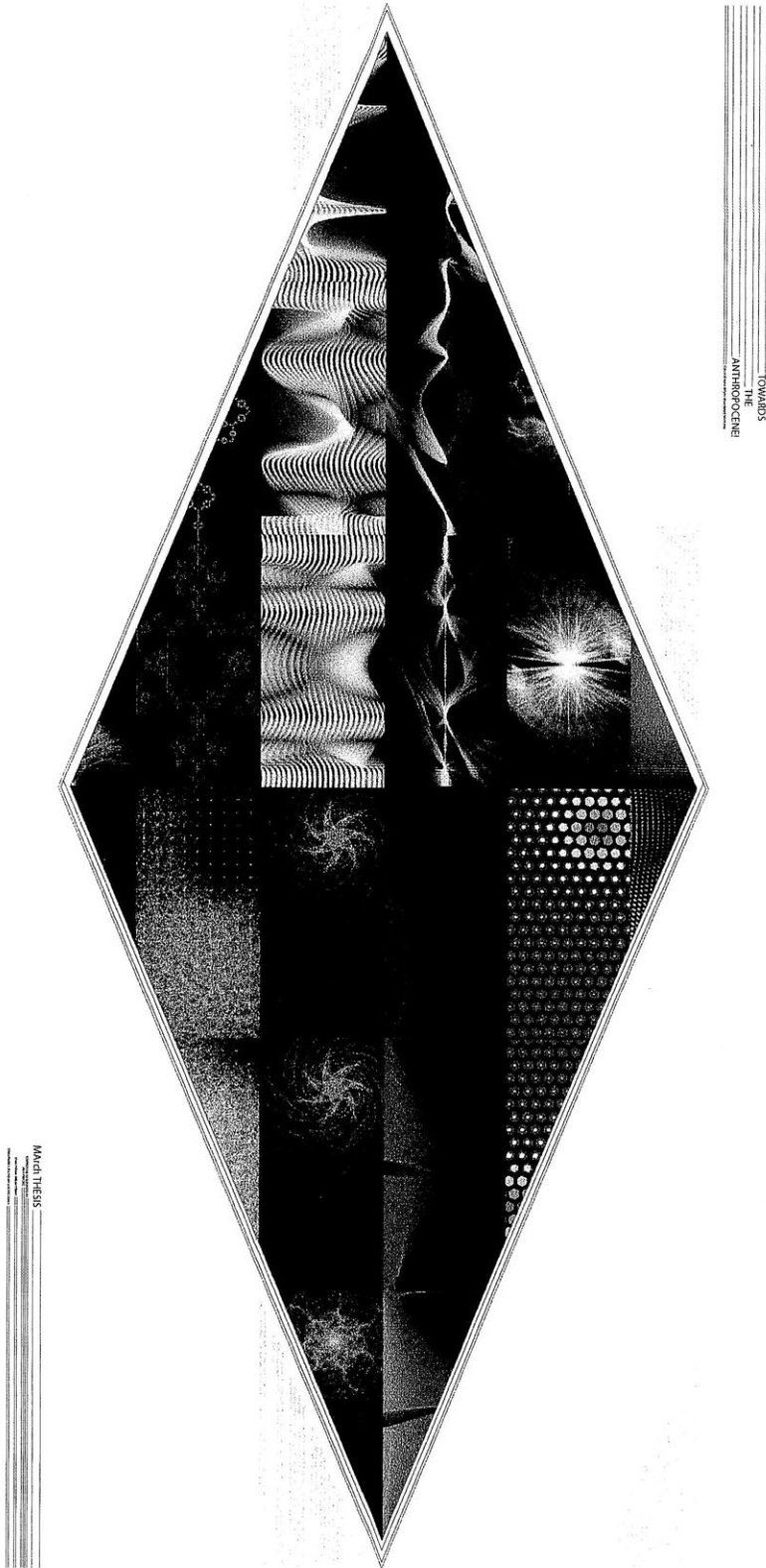
Welcome to new realities:

Welcome to the Anthropocene!"

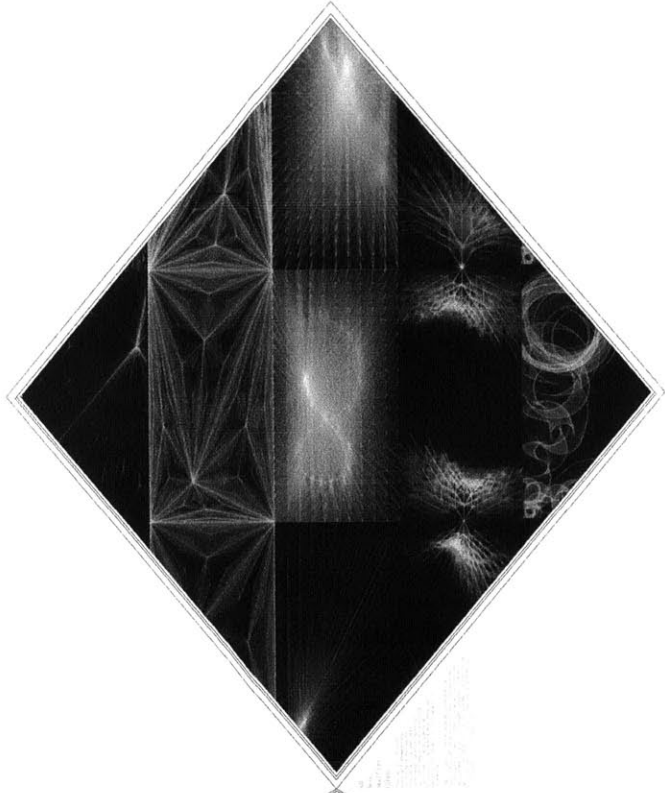
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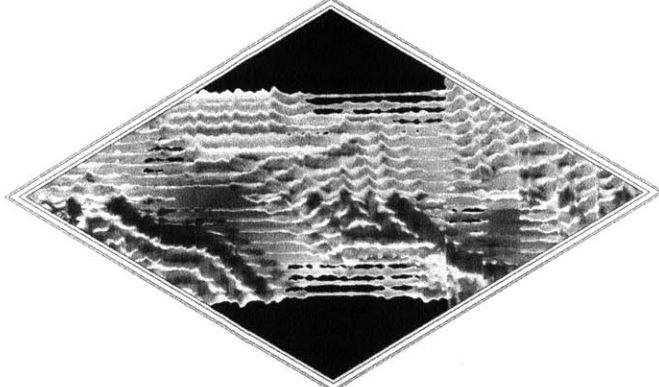
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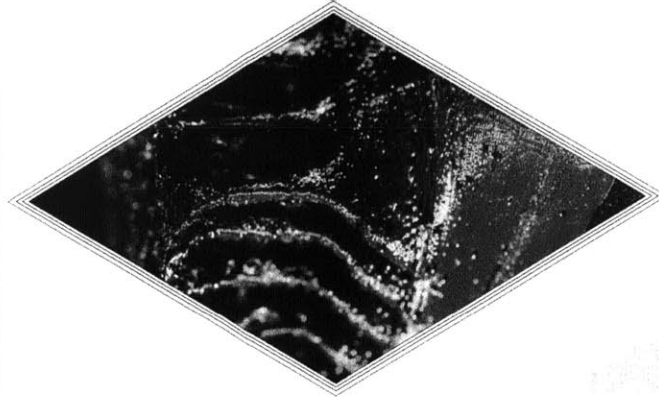
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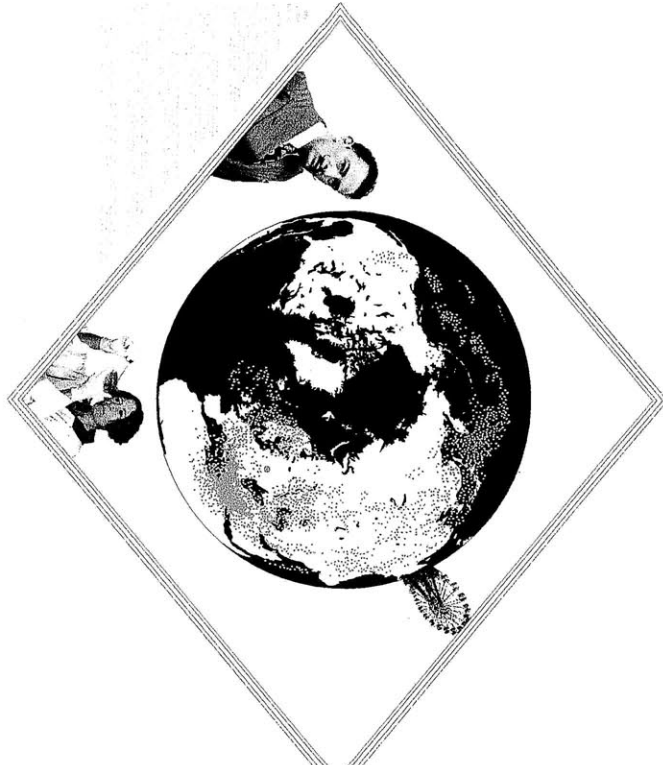
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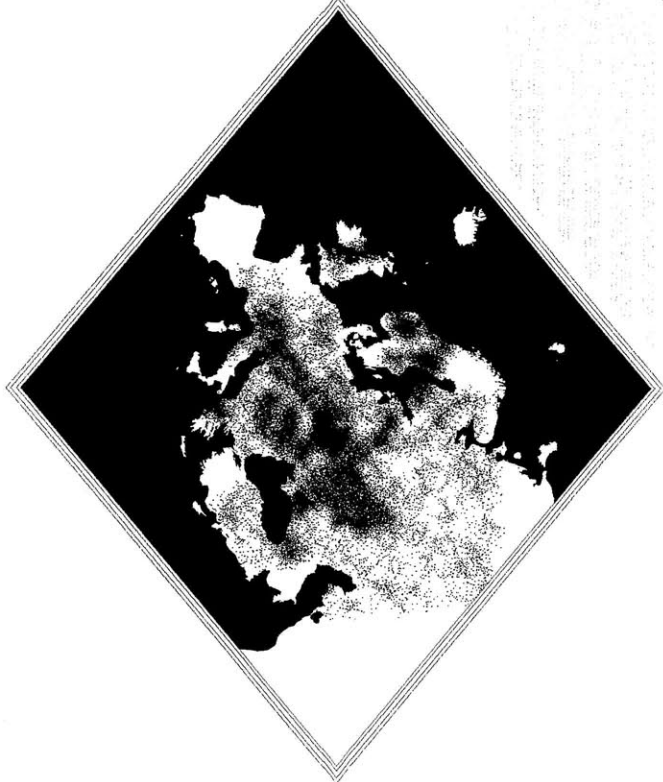
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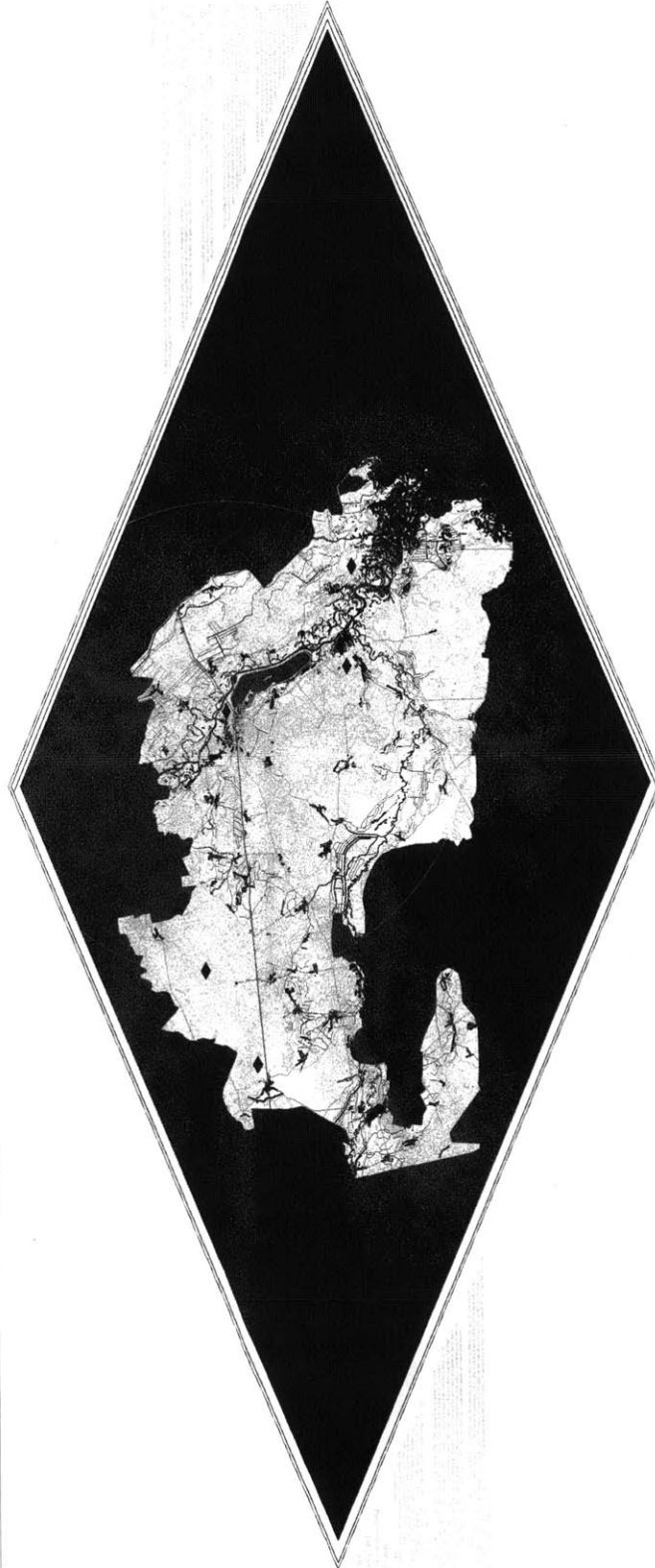


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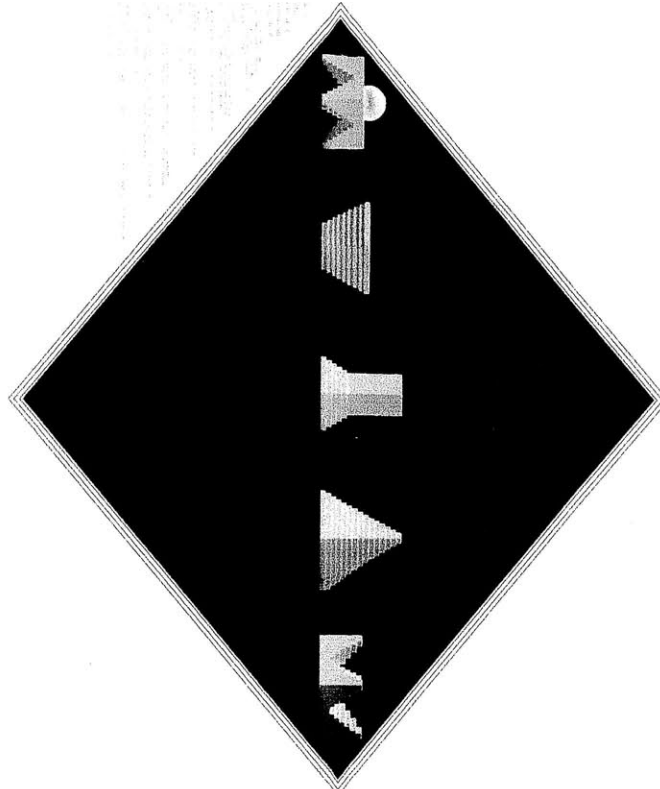
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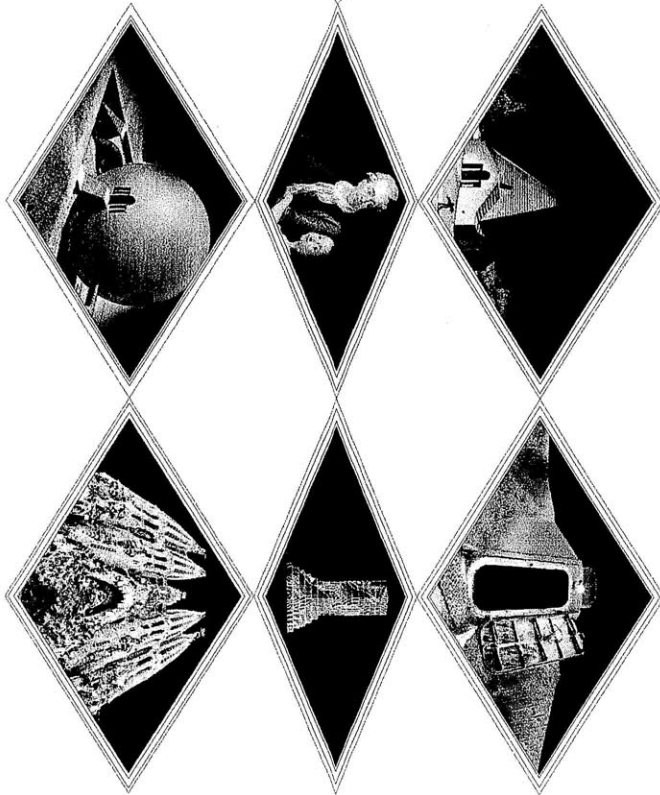
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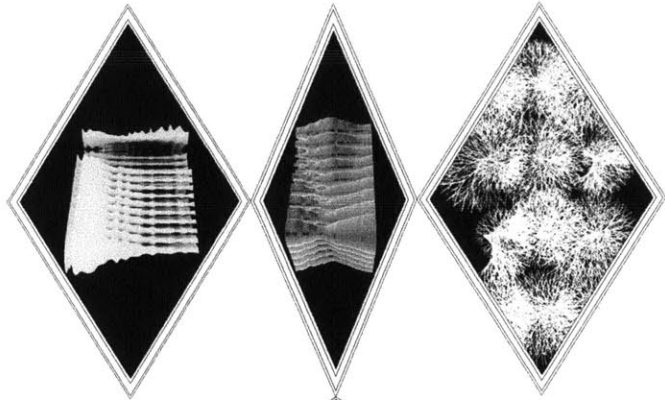


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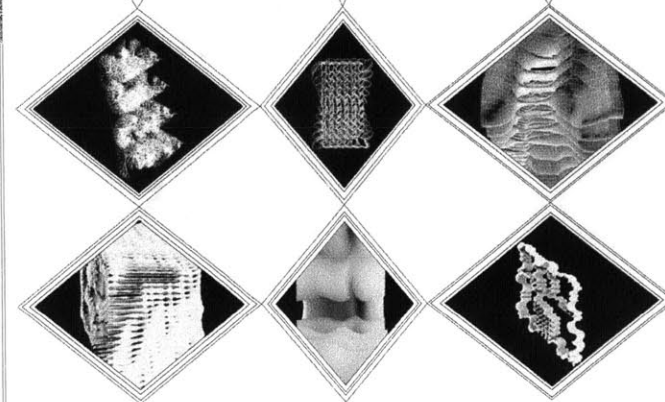
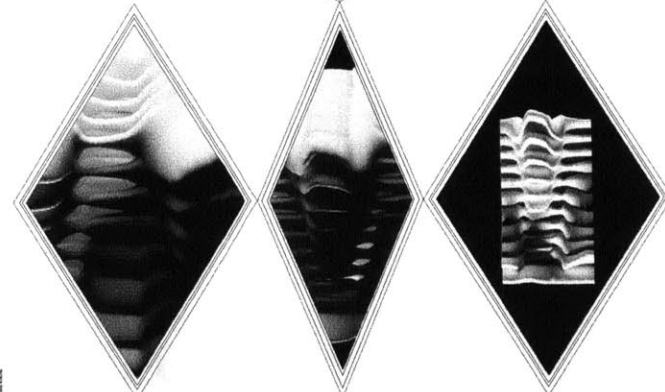
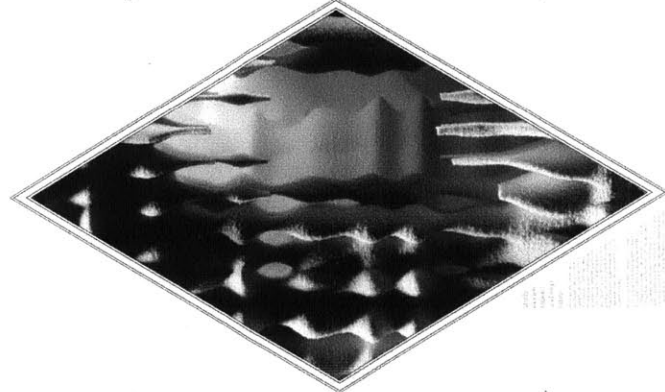


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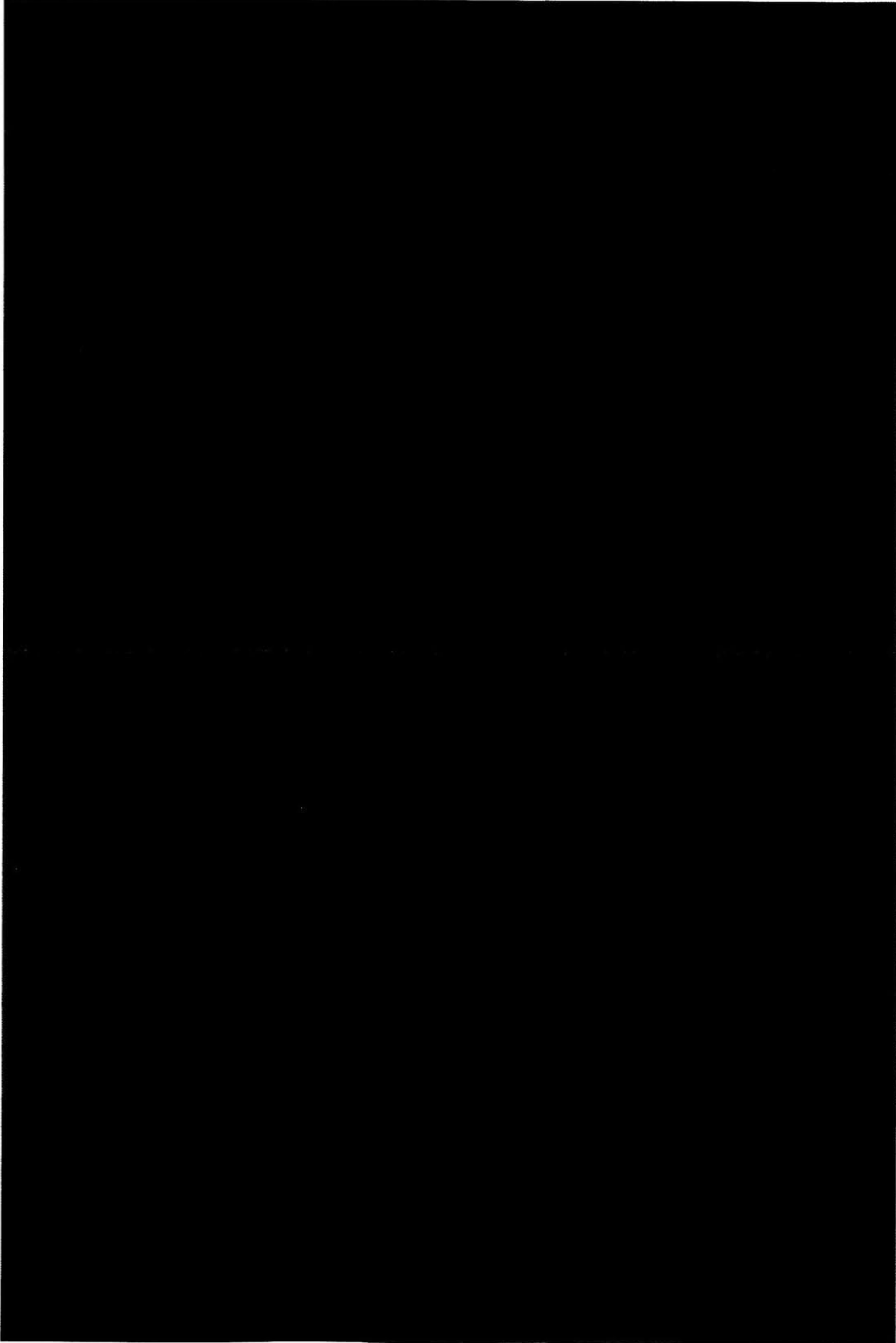
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Drawings and Discourse



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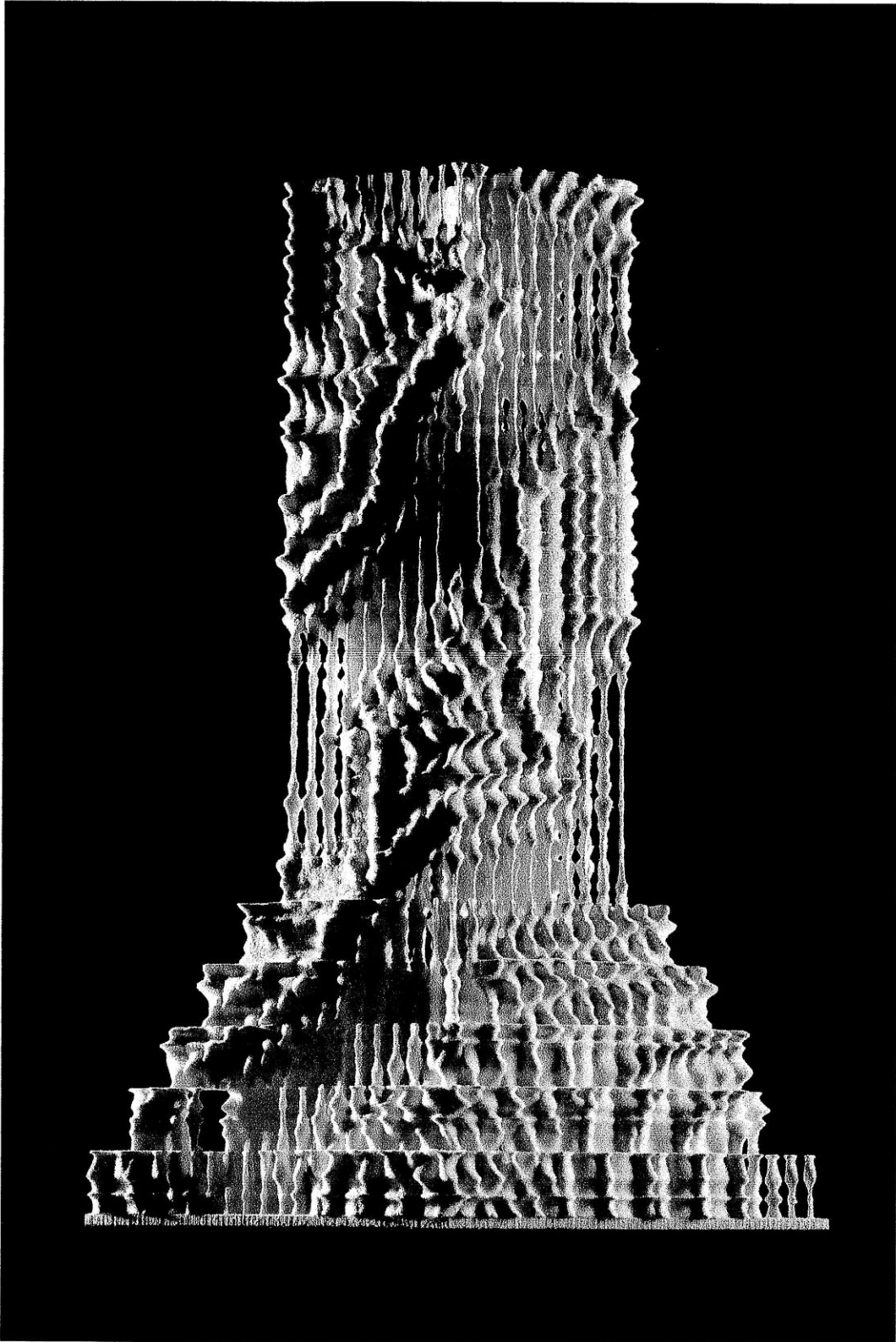
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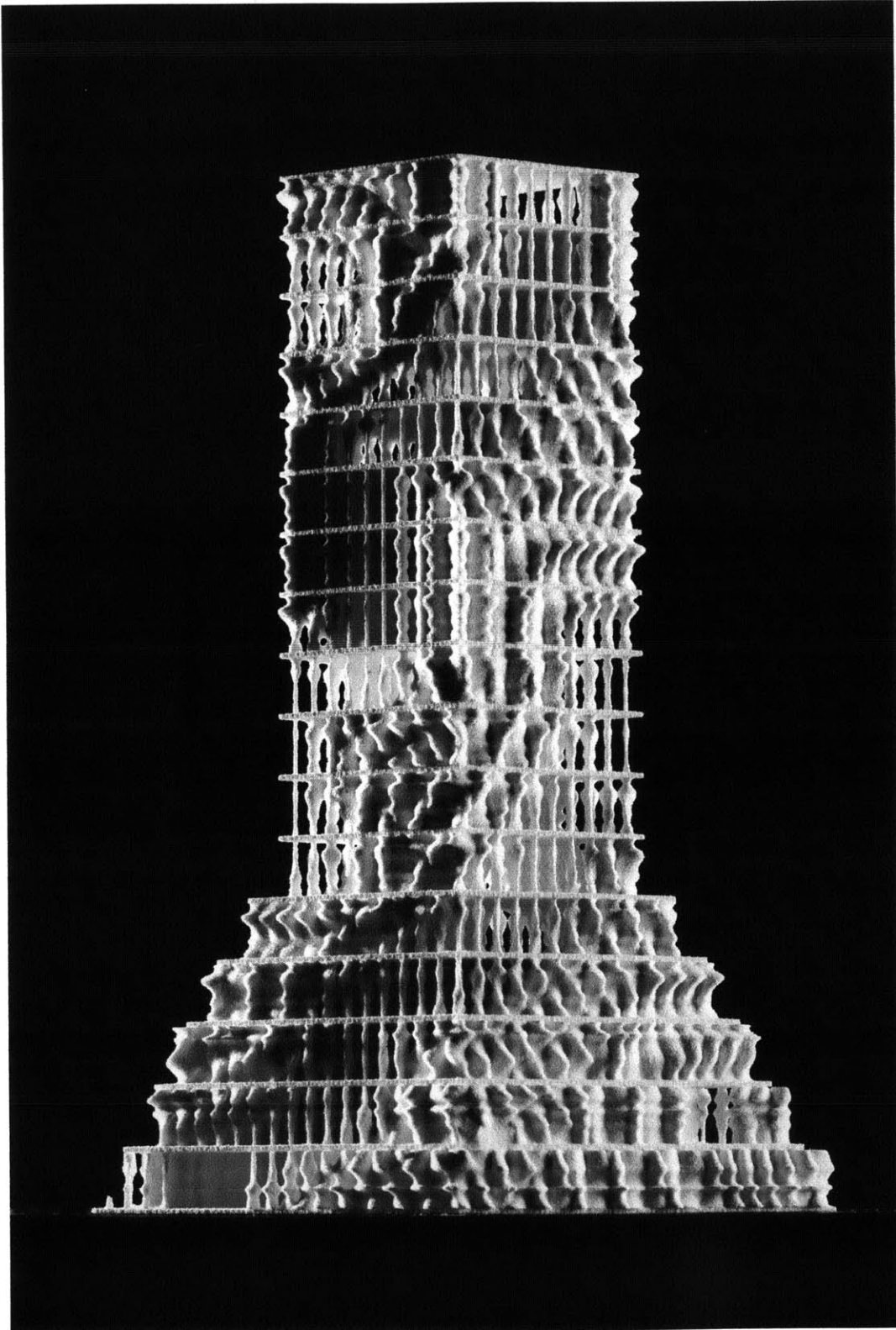
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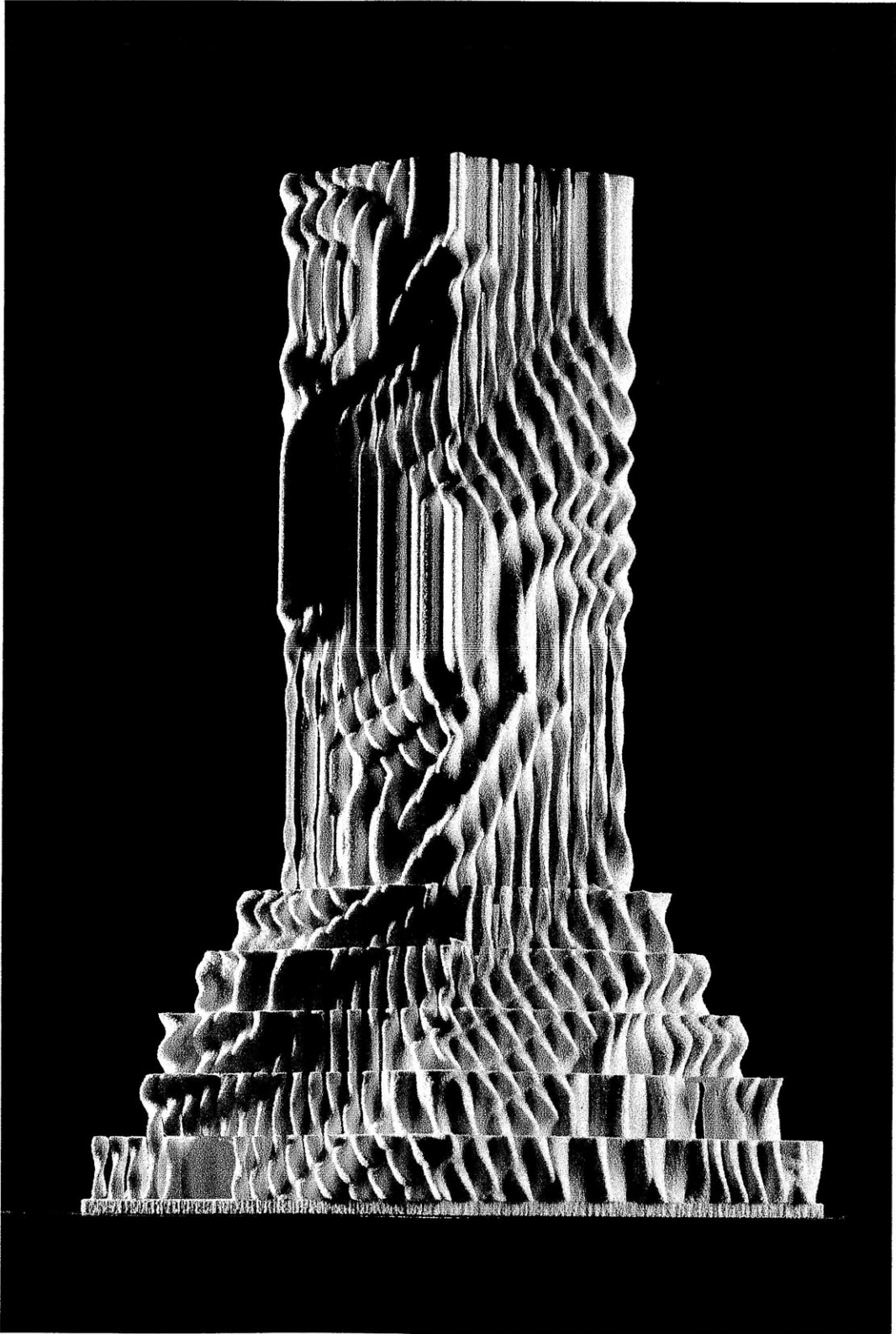


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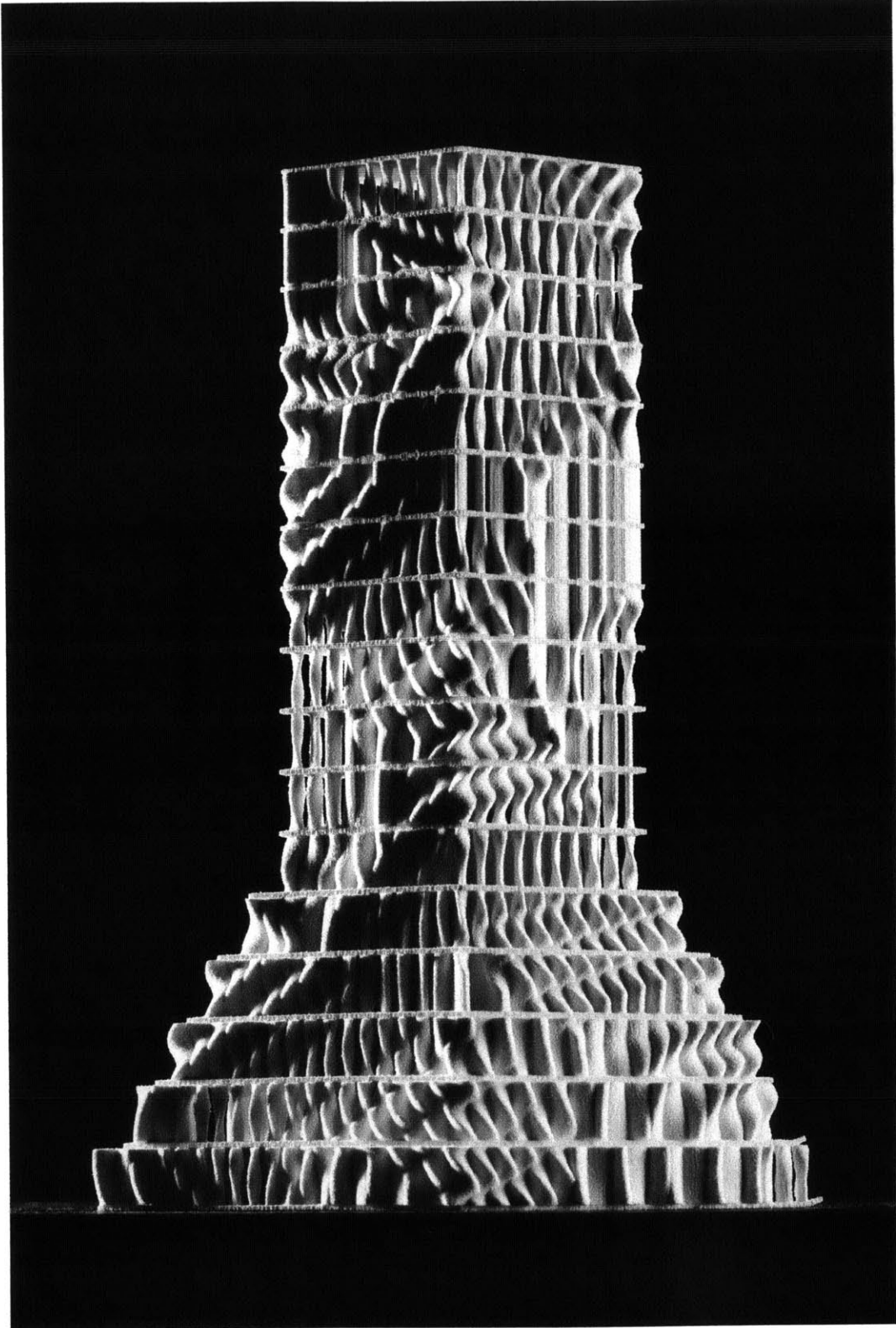


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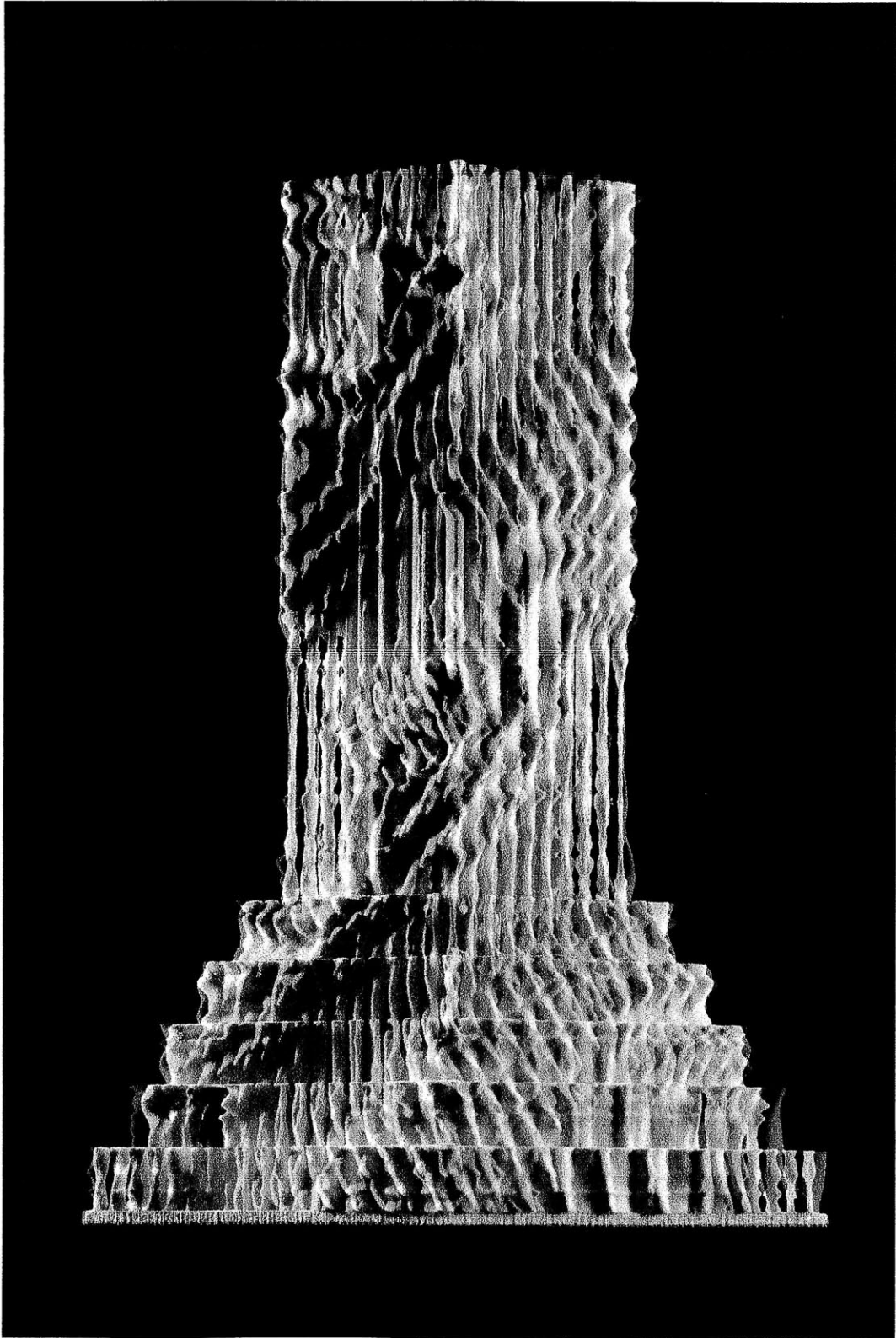


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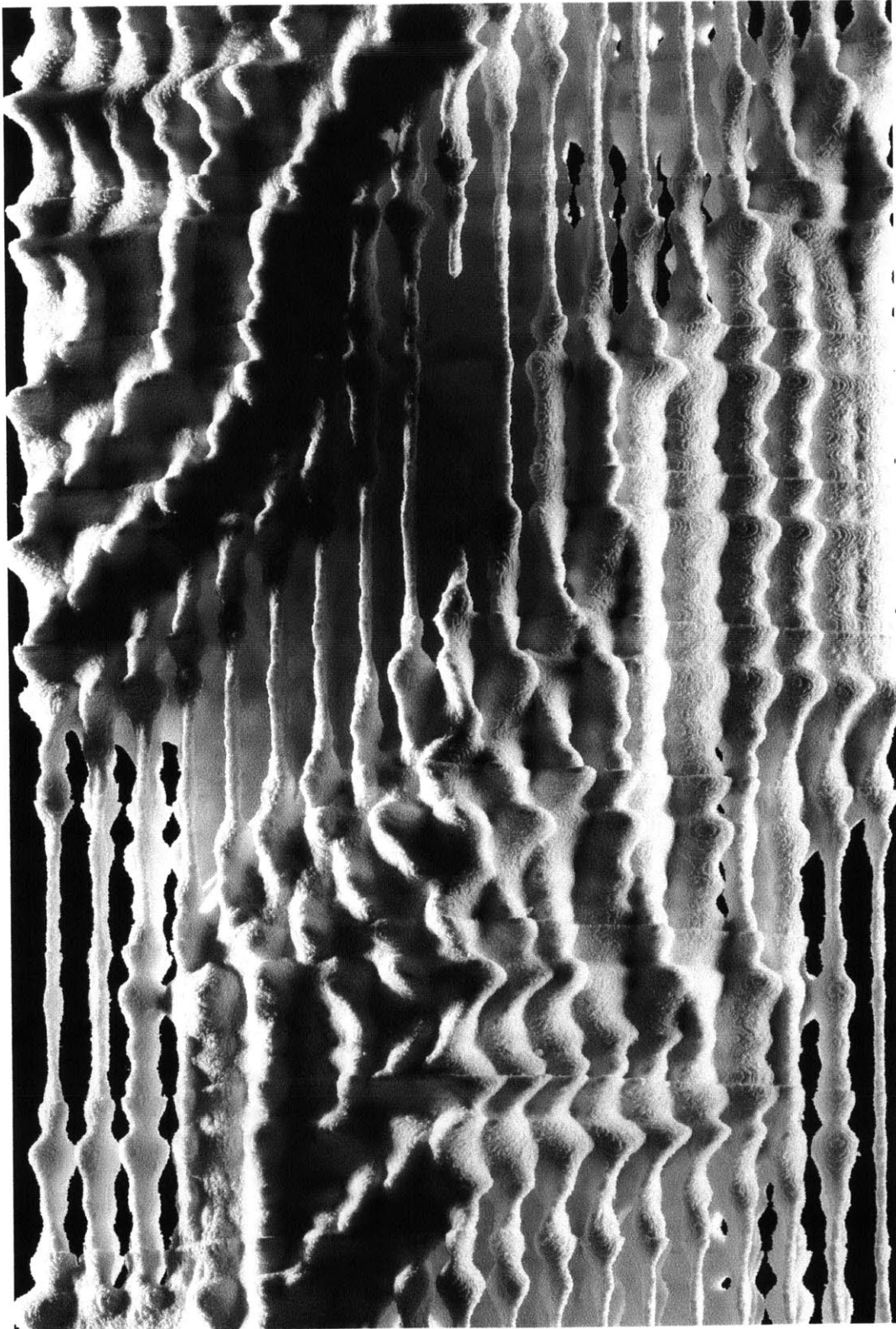


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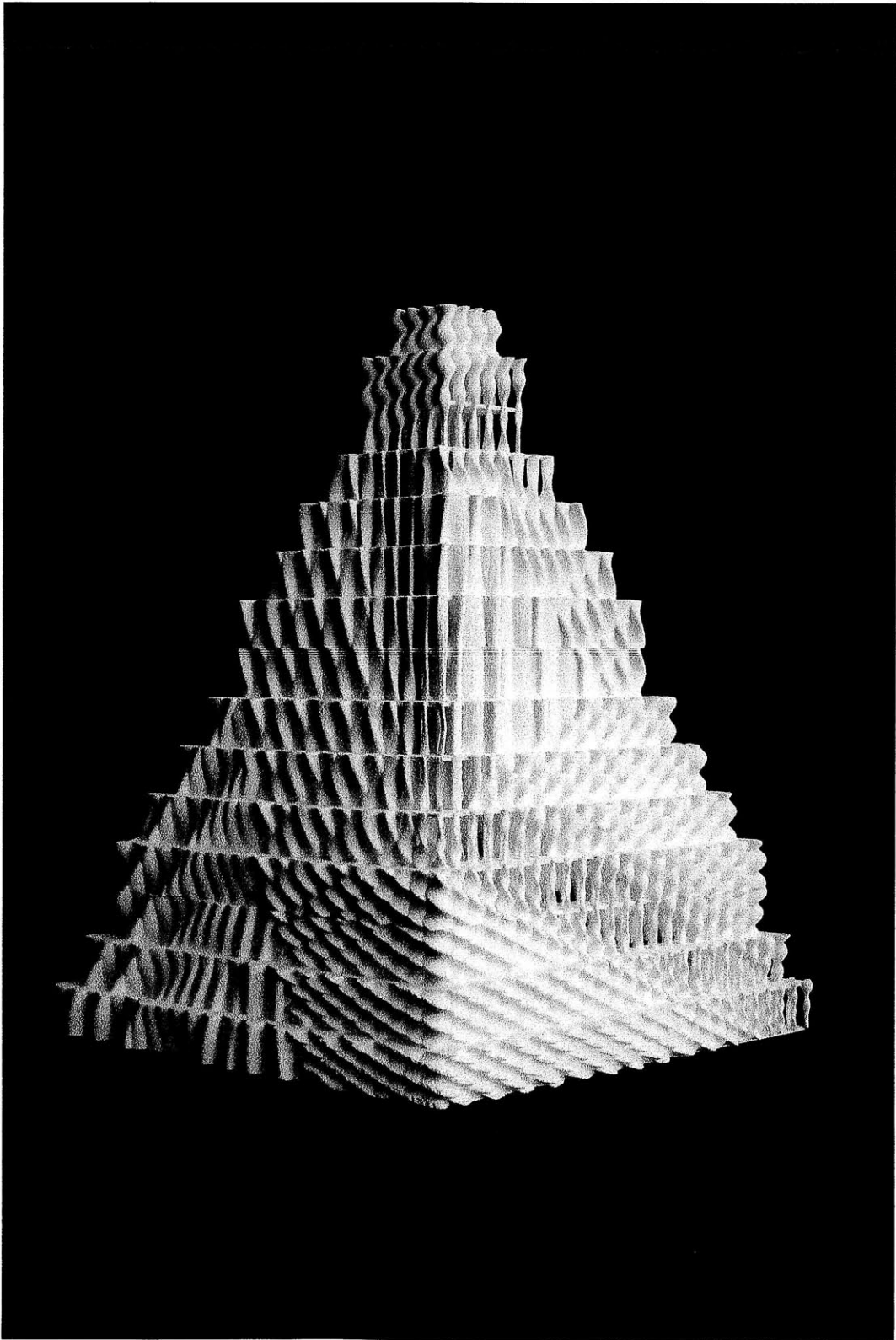


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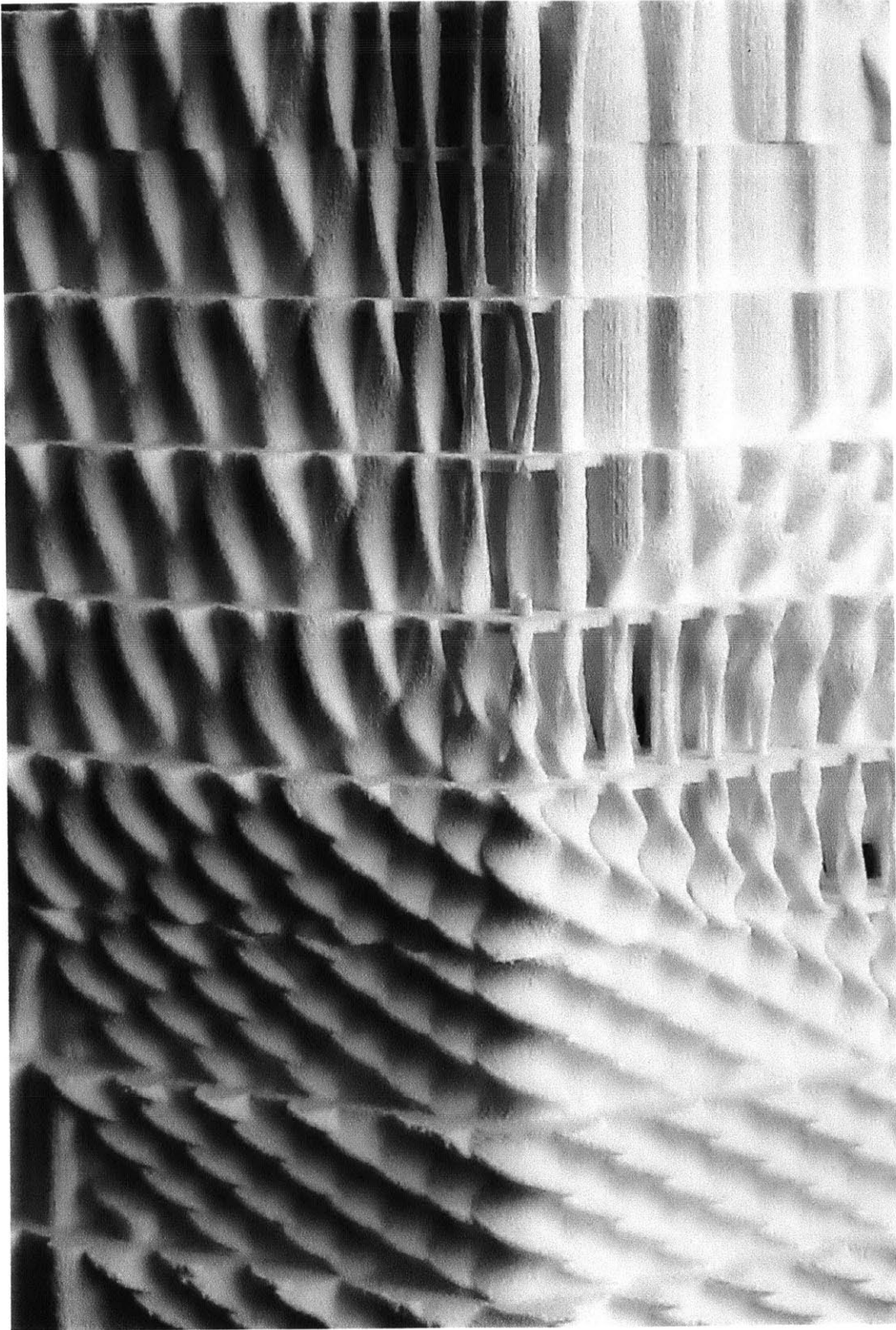


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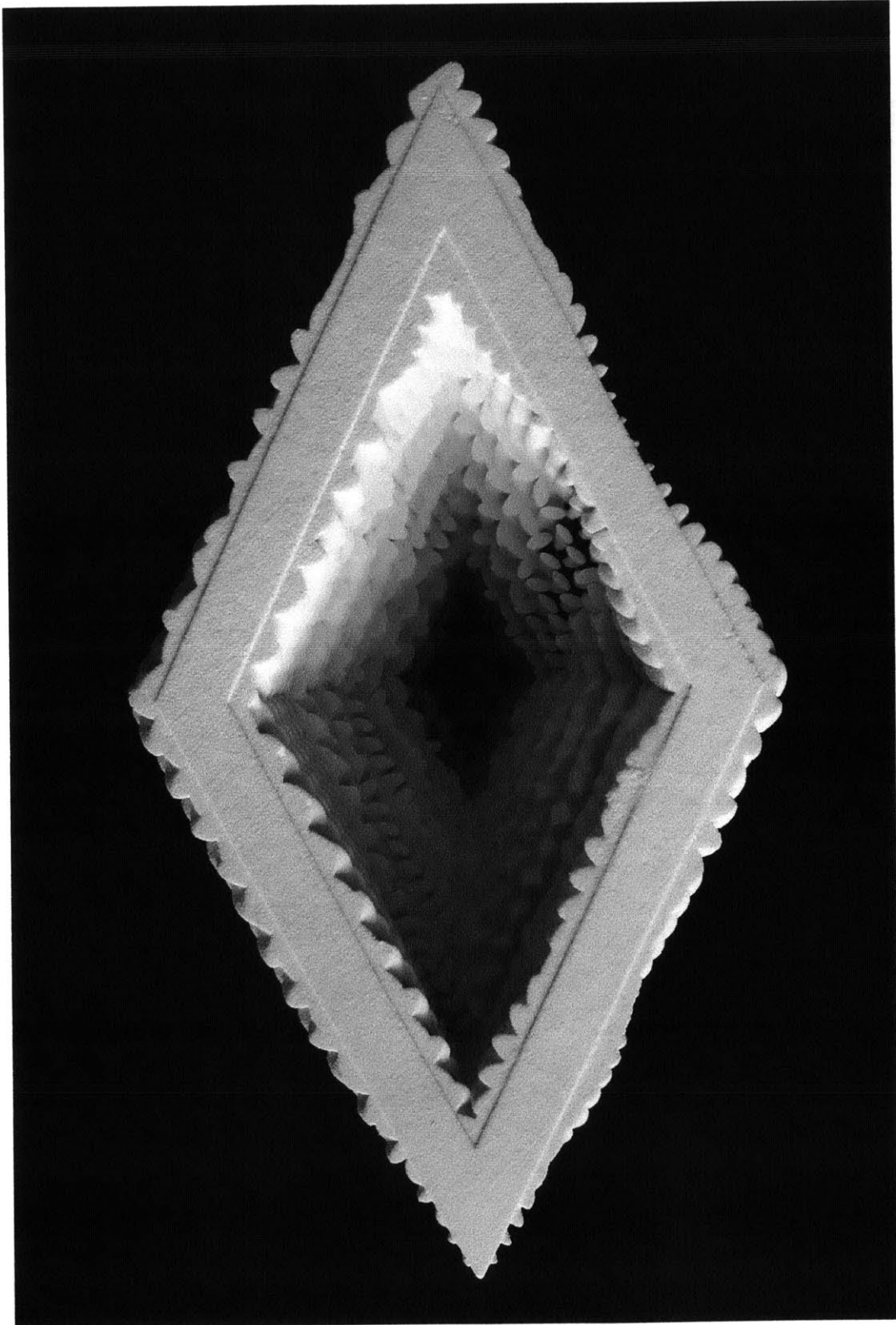
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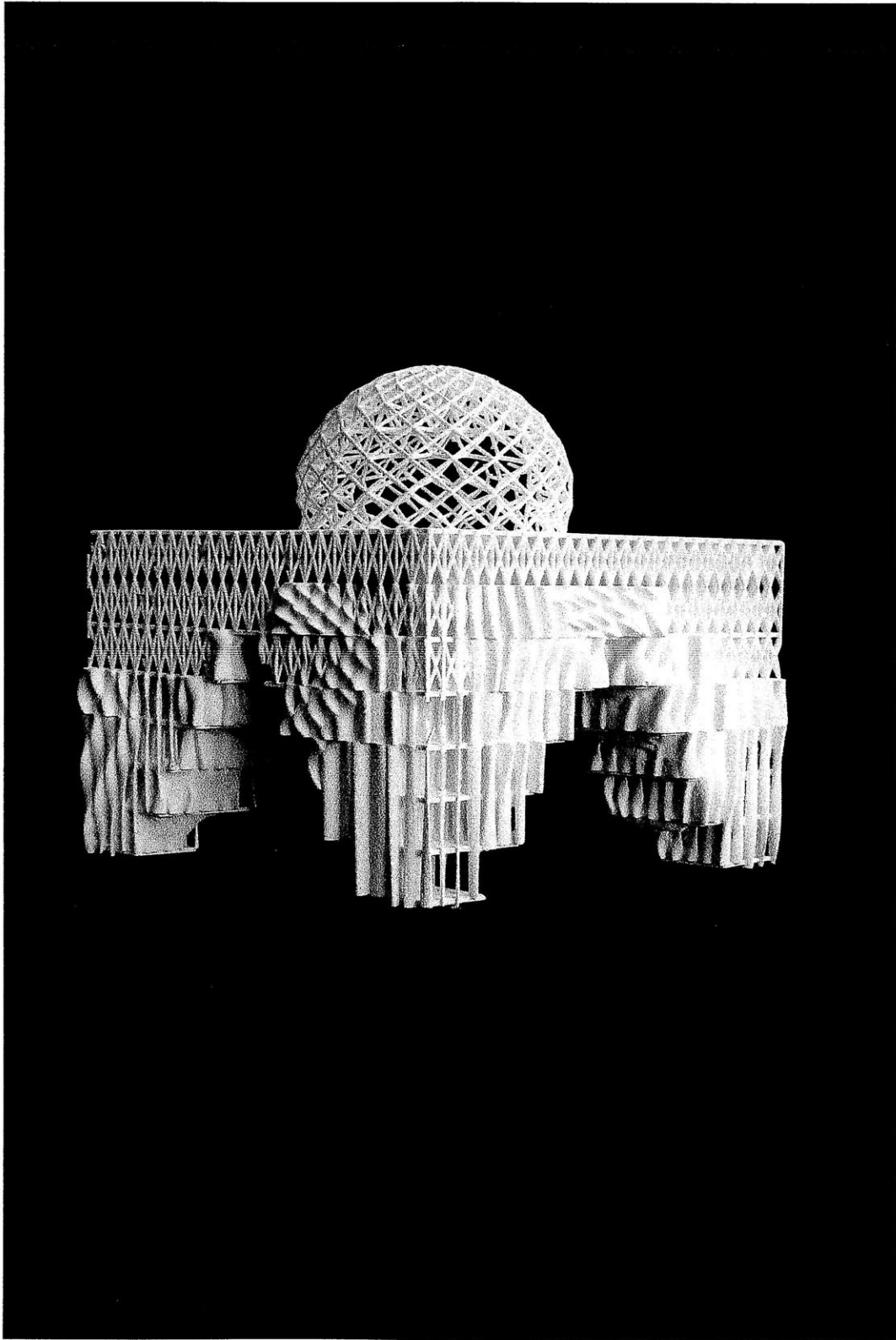
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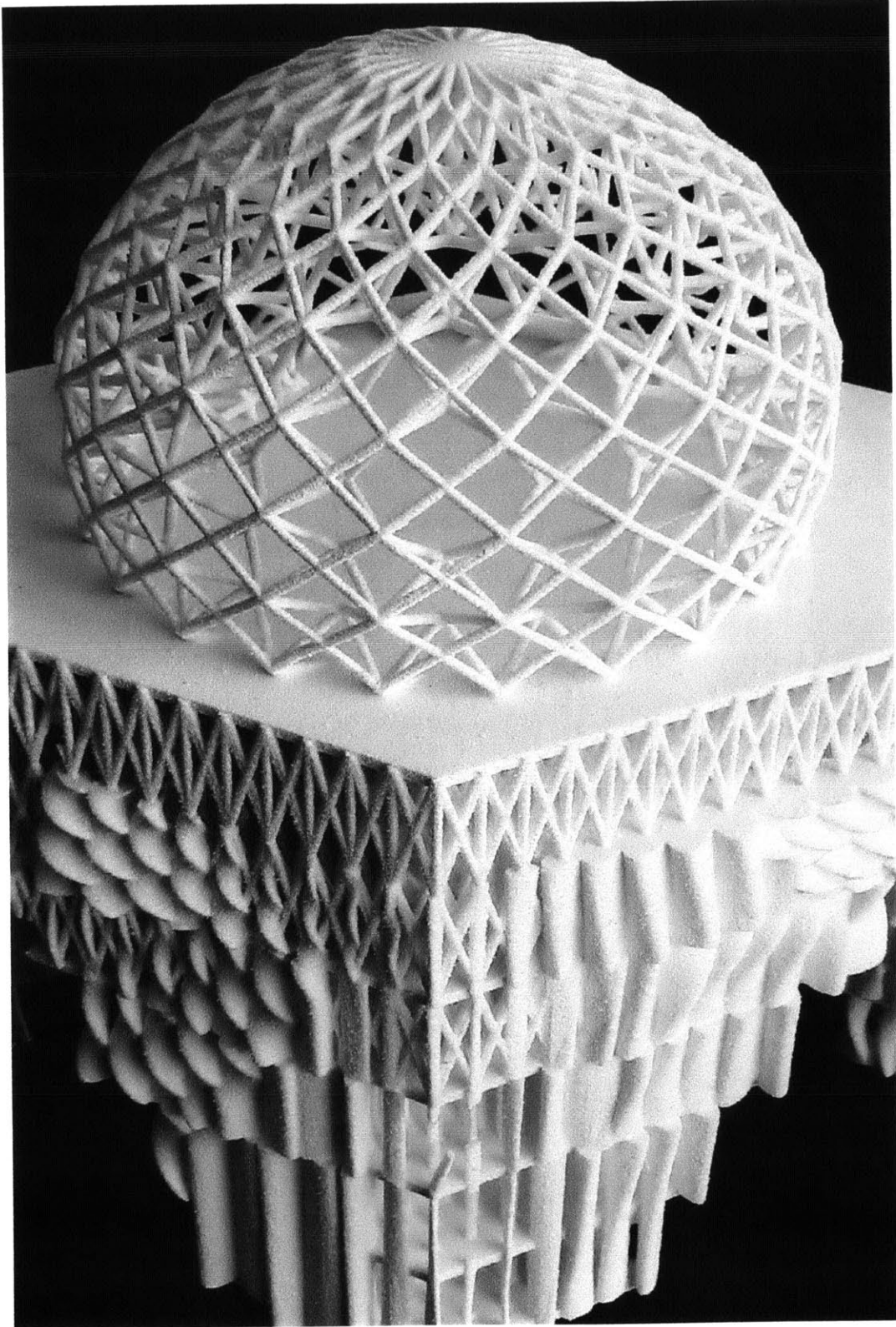
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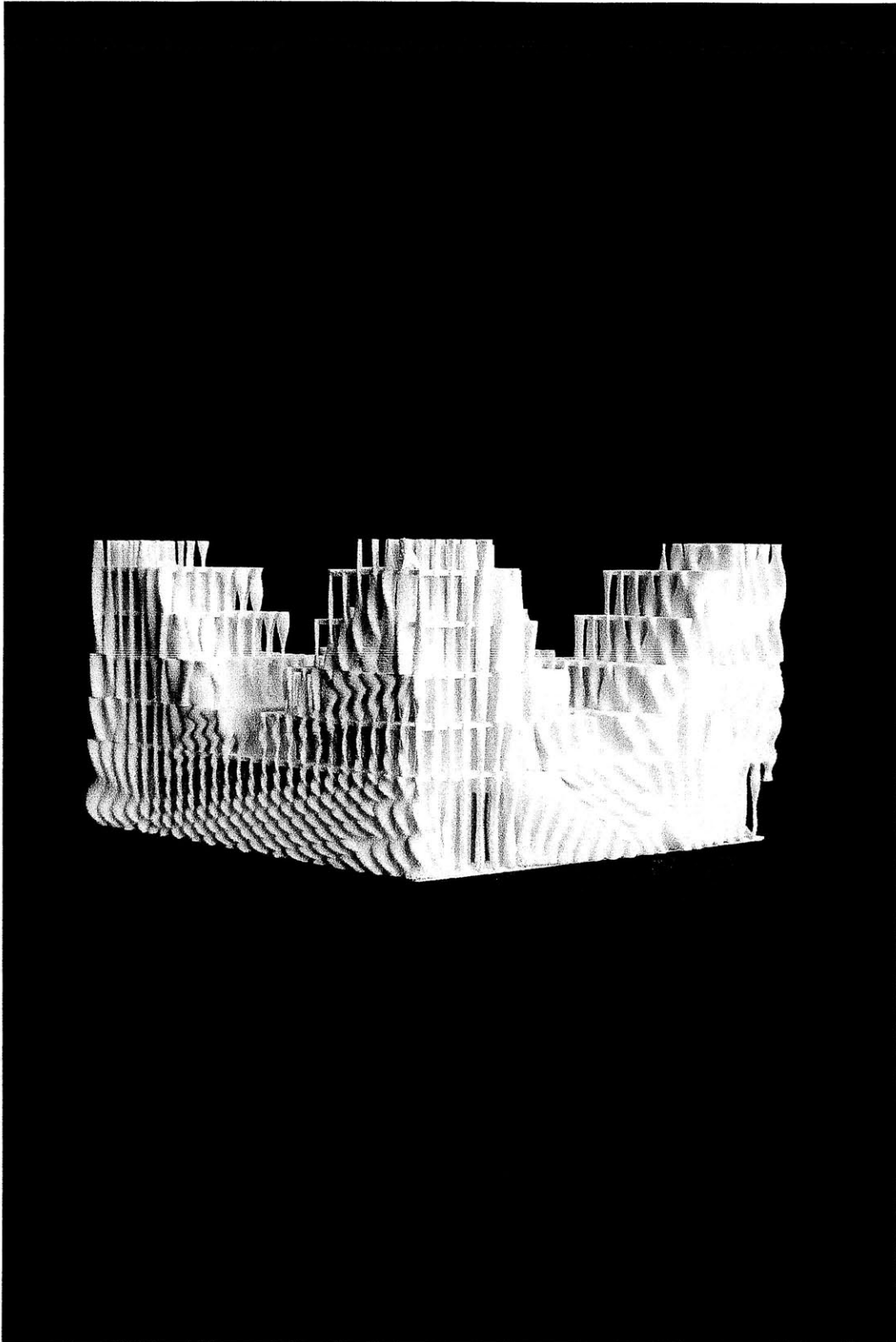
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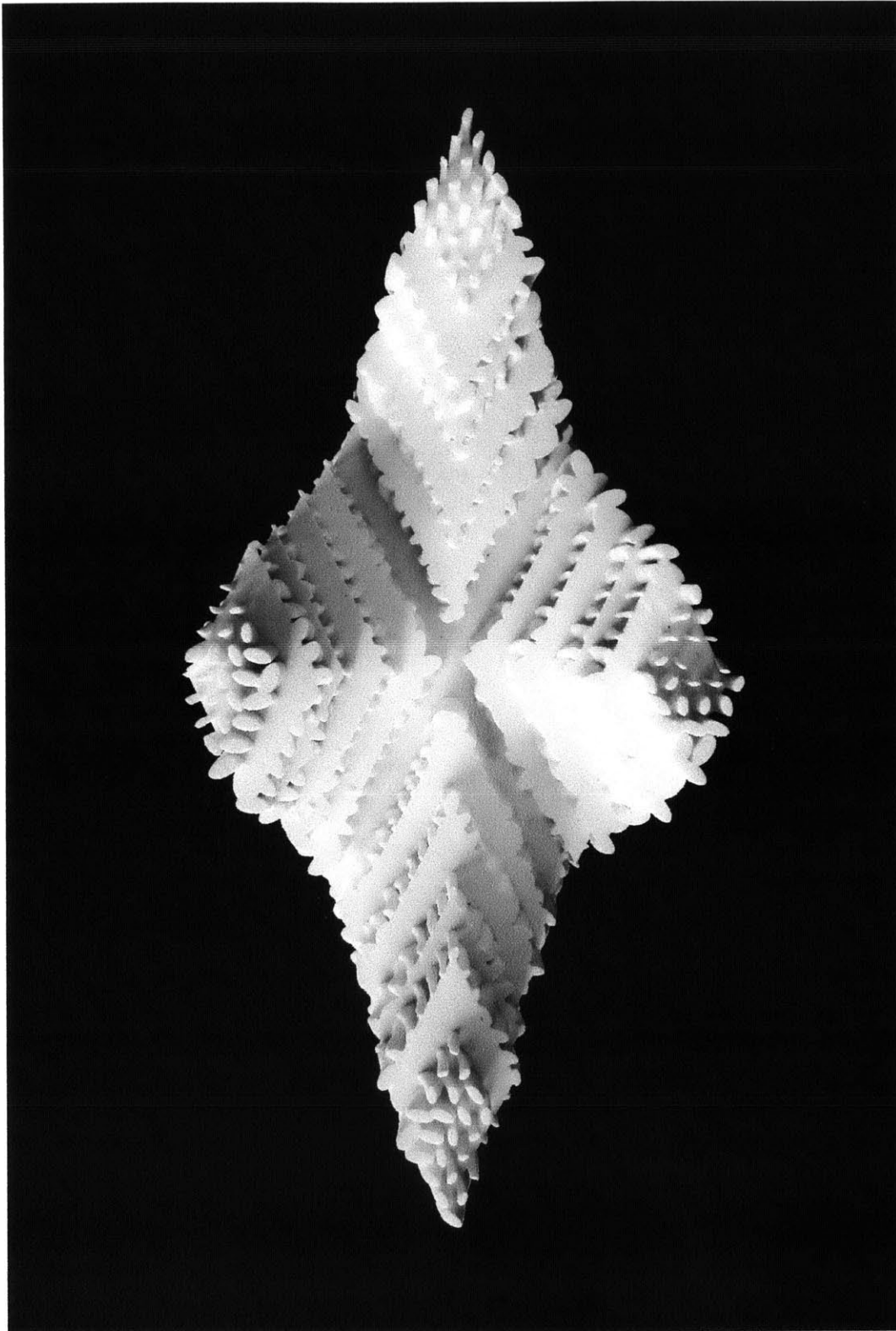


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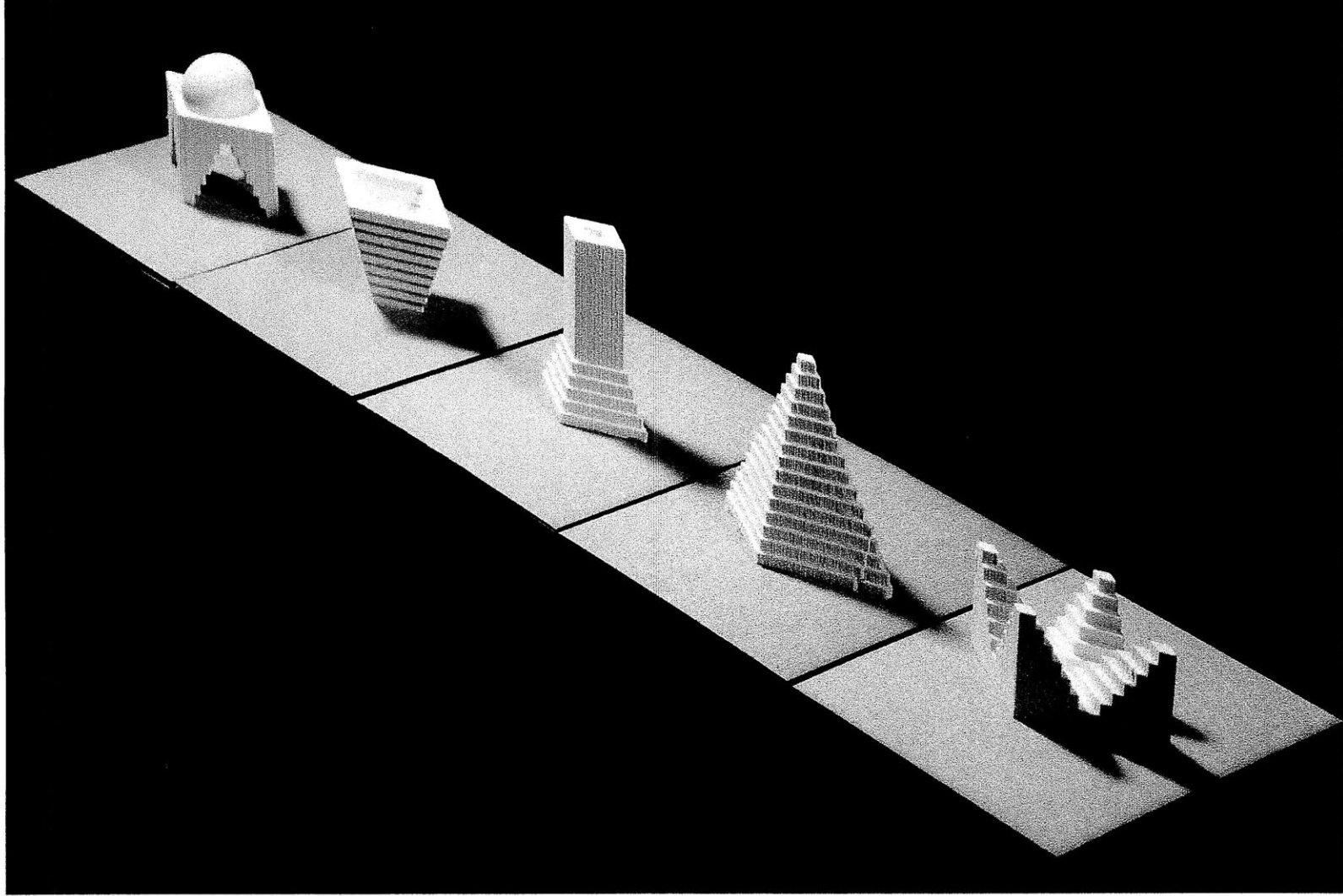


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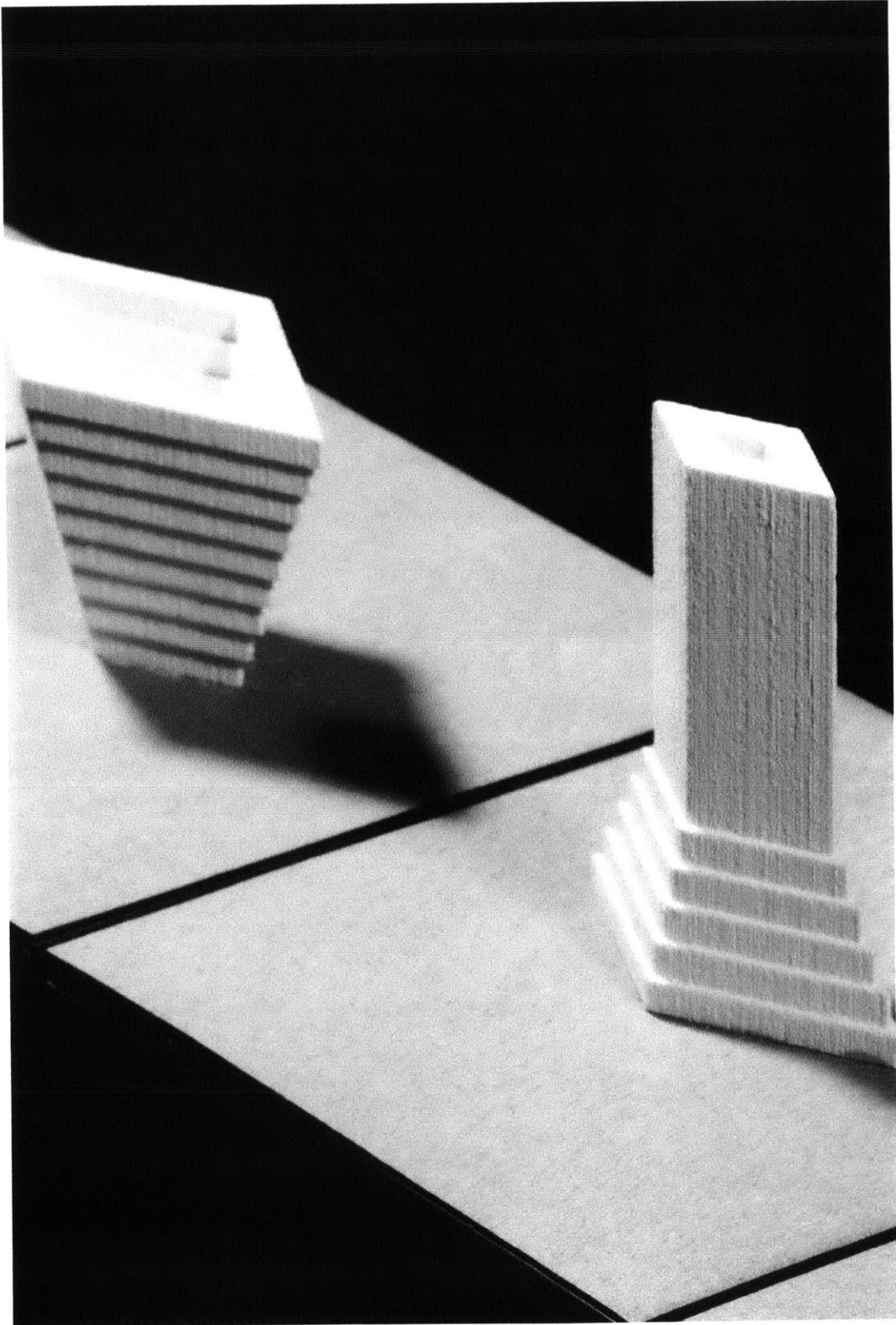
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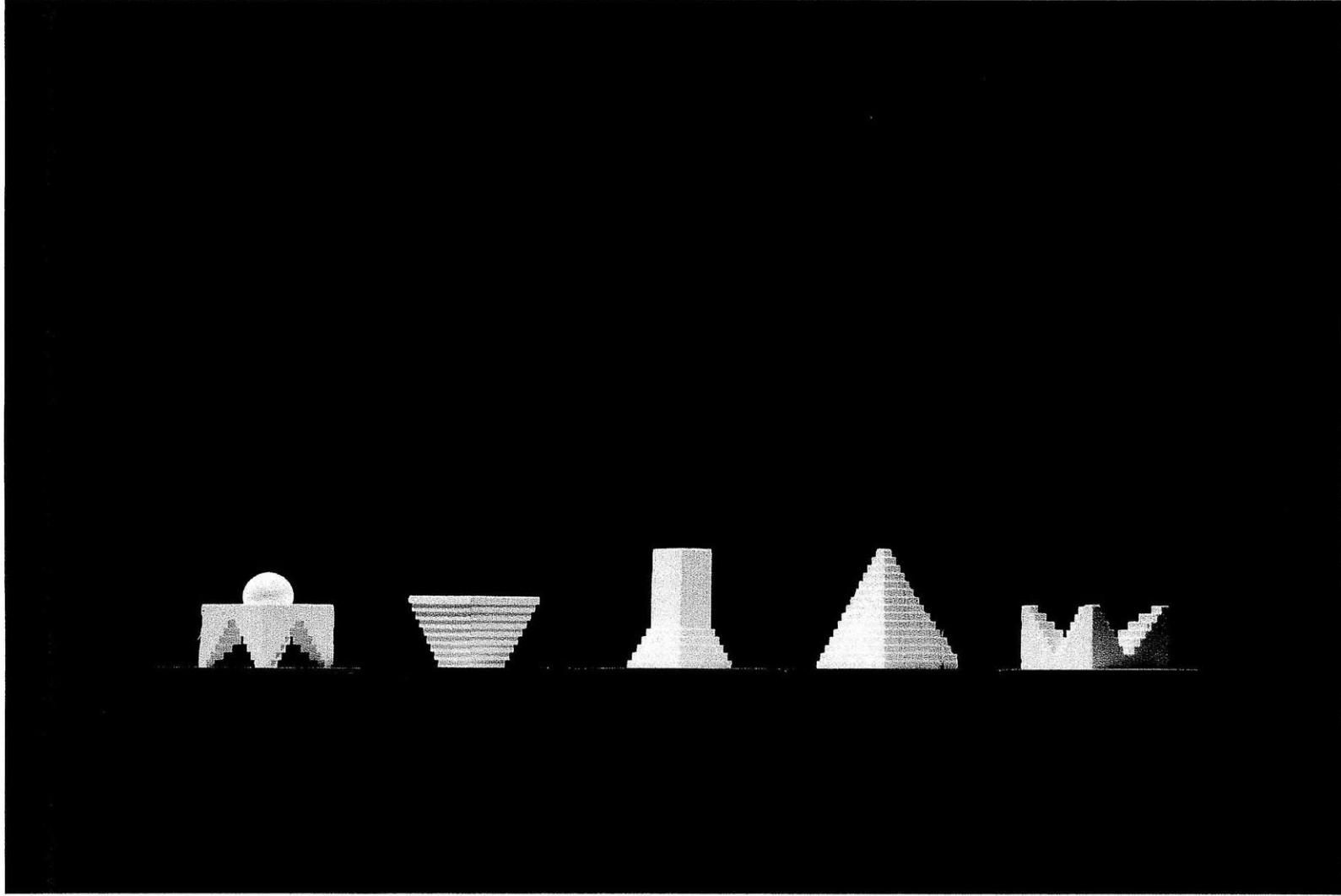
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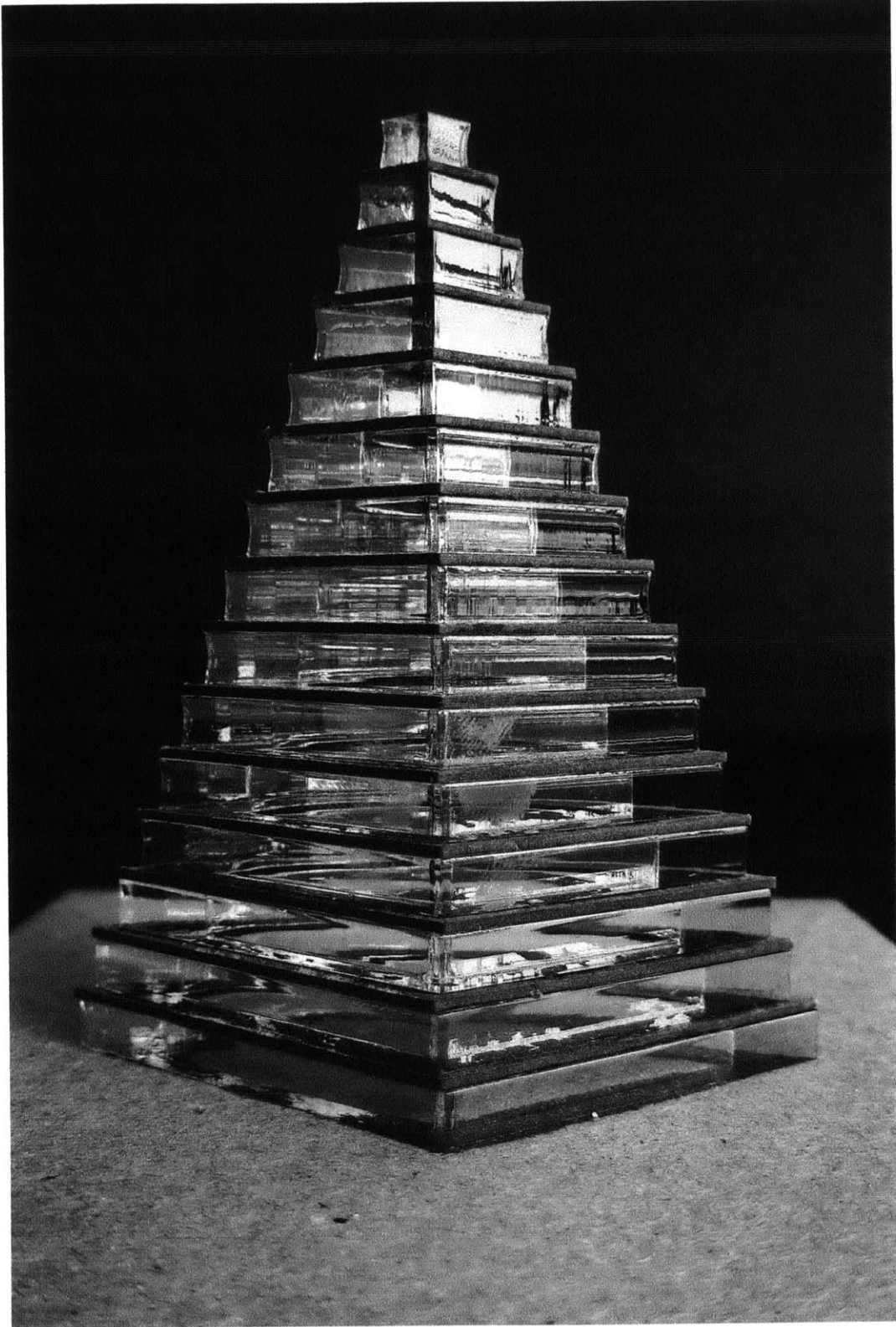
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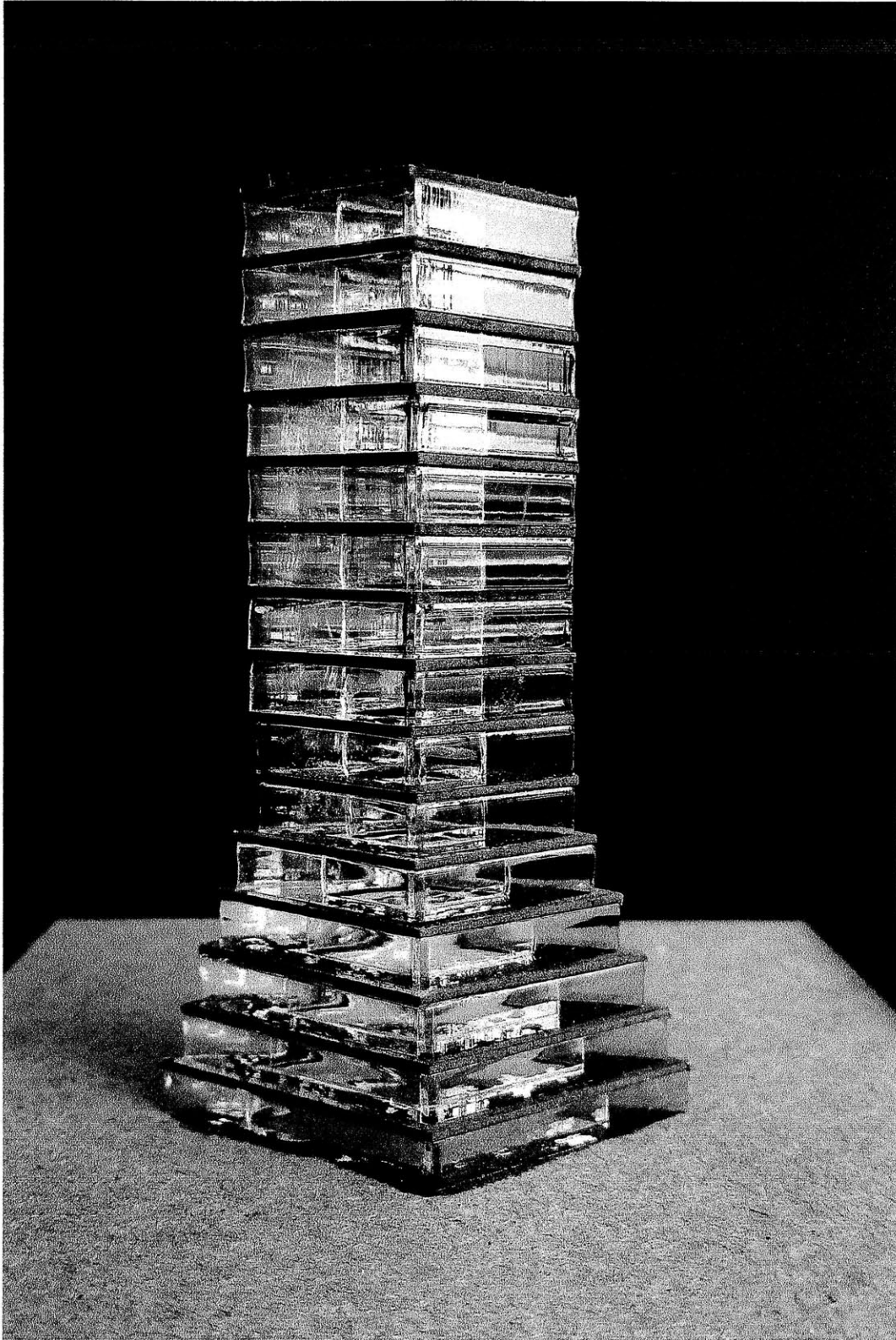
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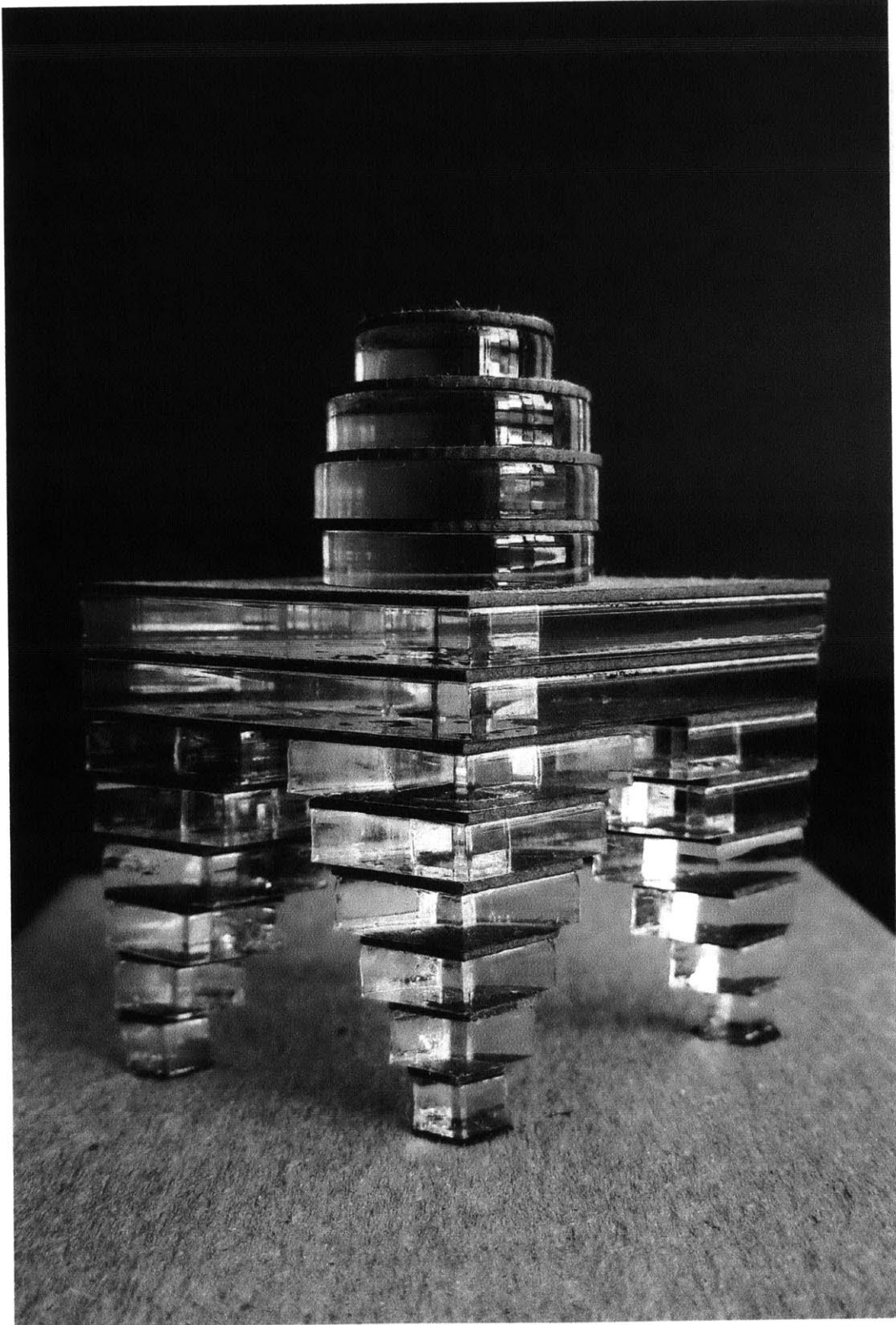
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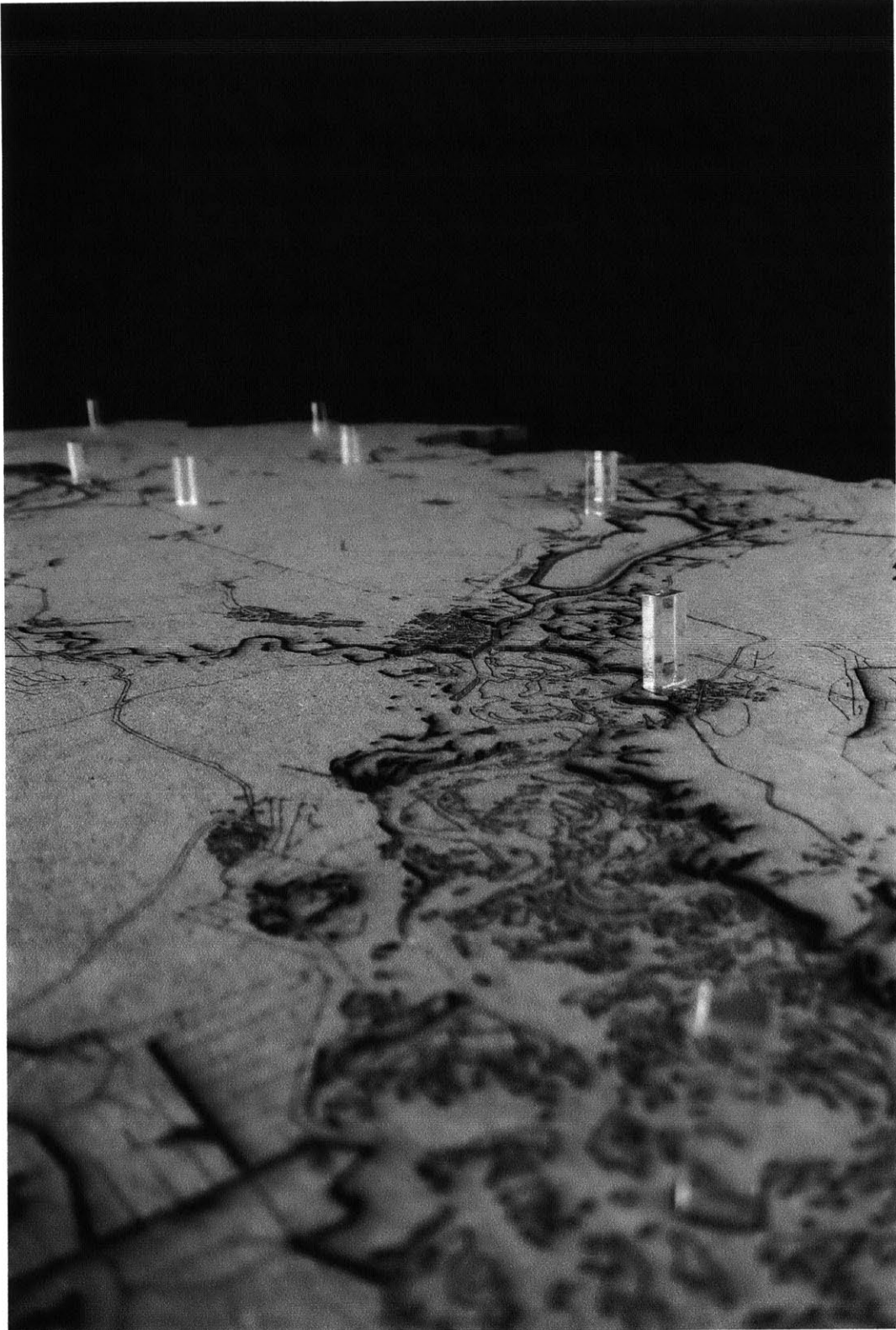


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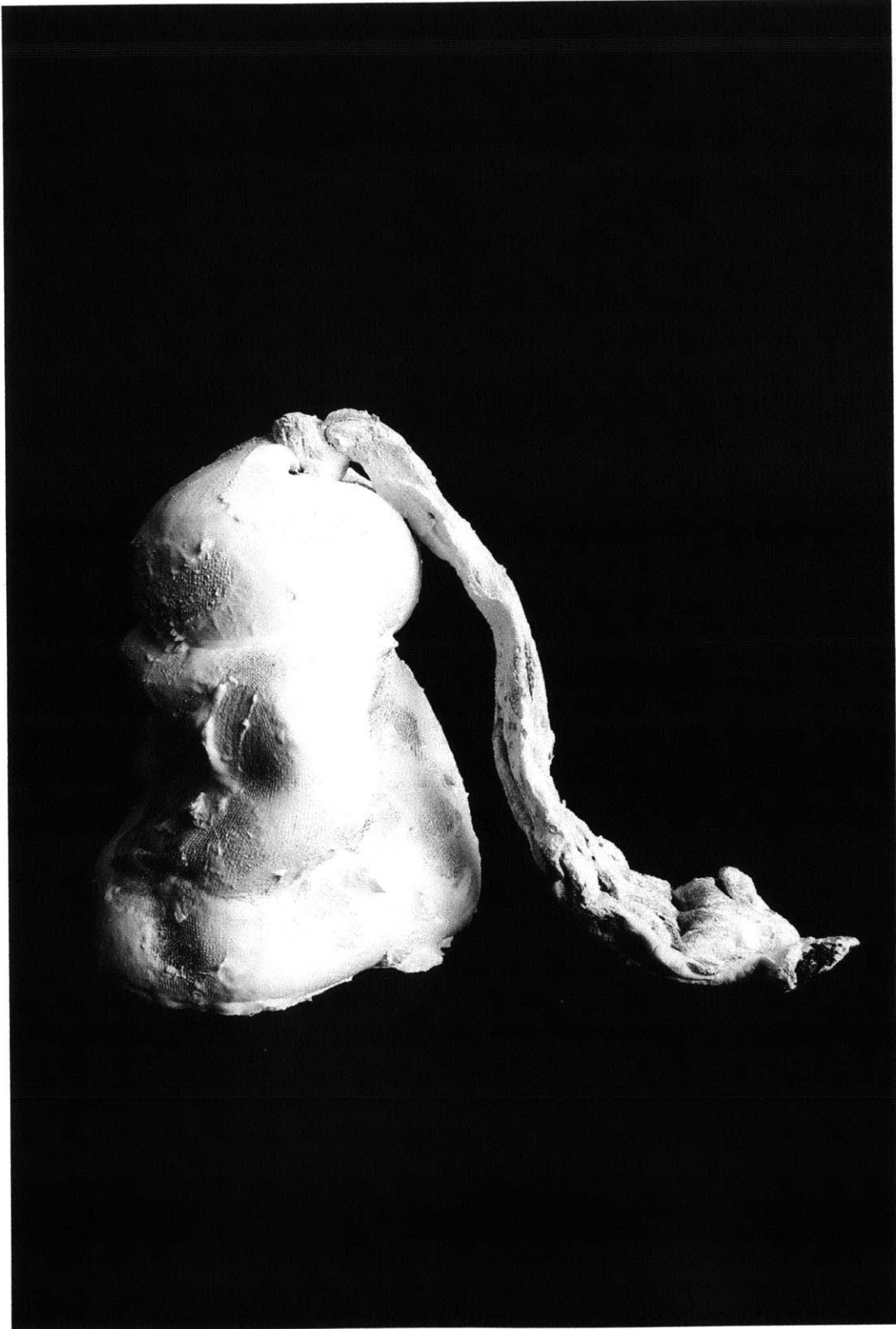


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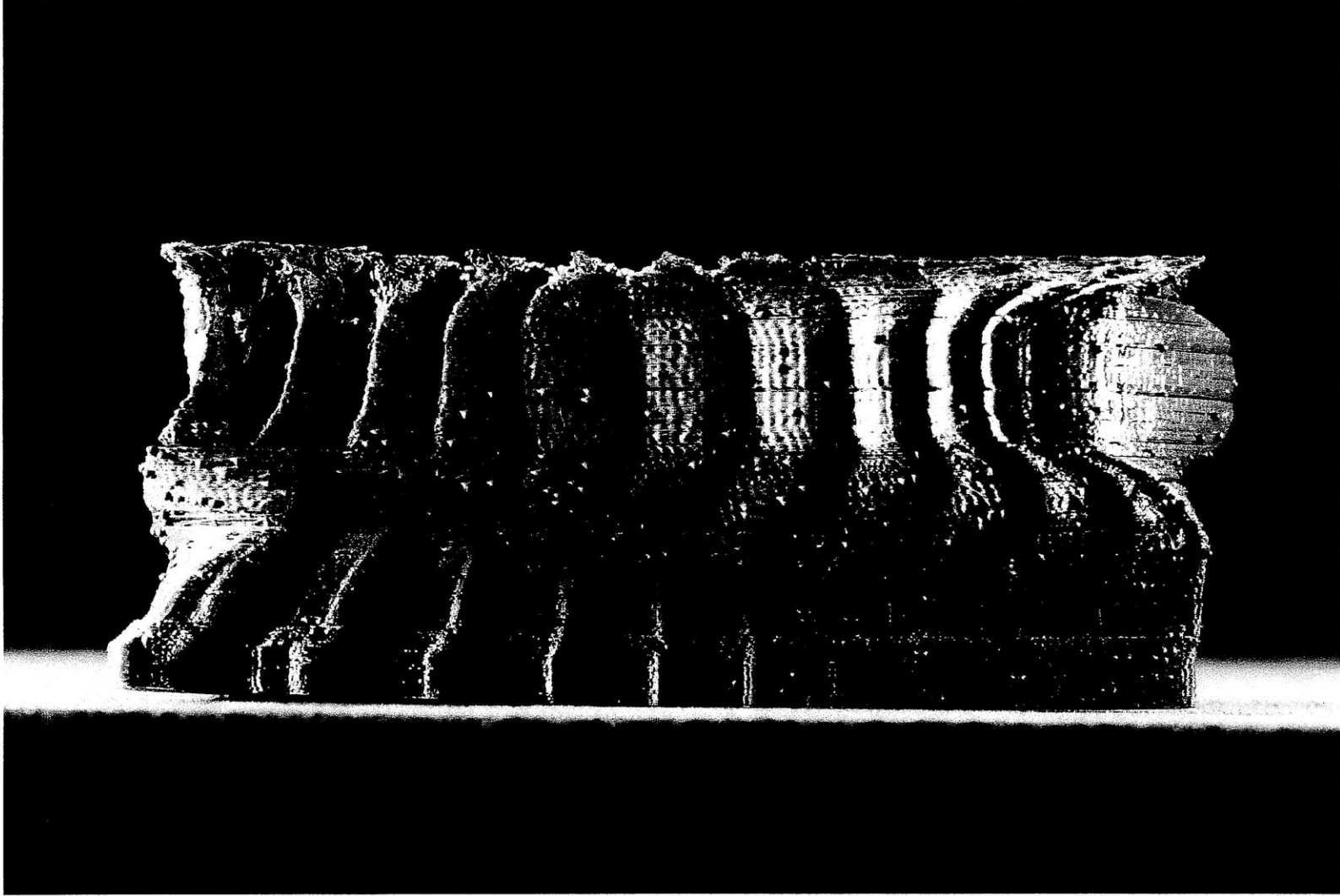


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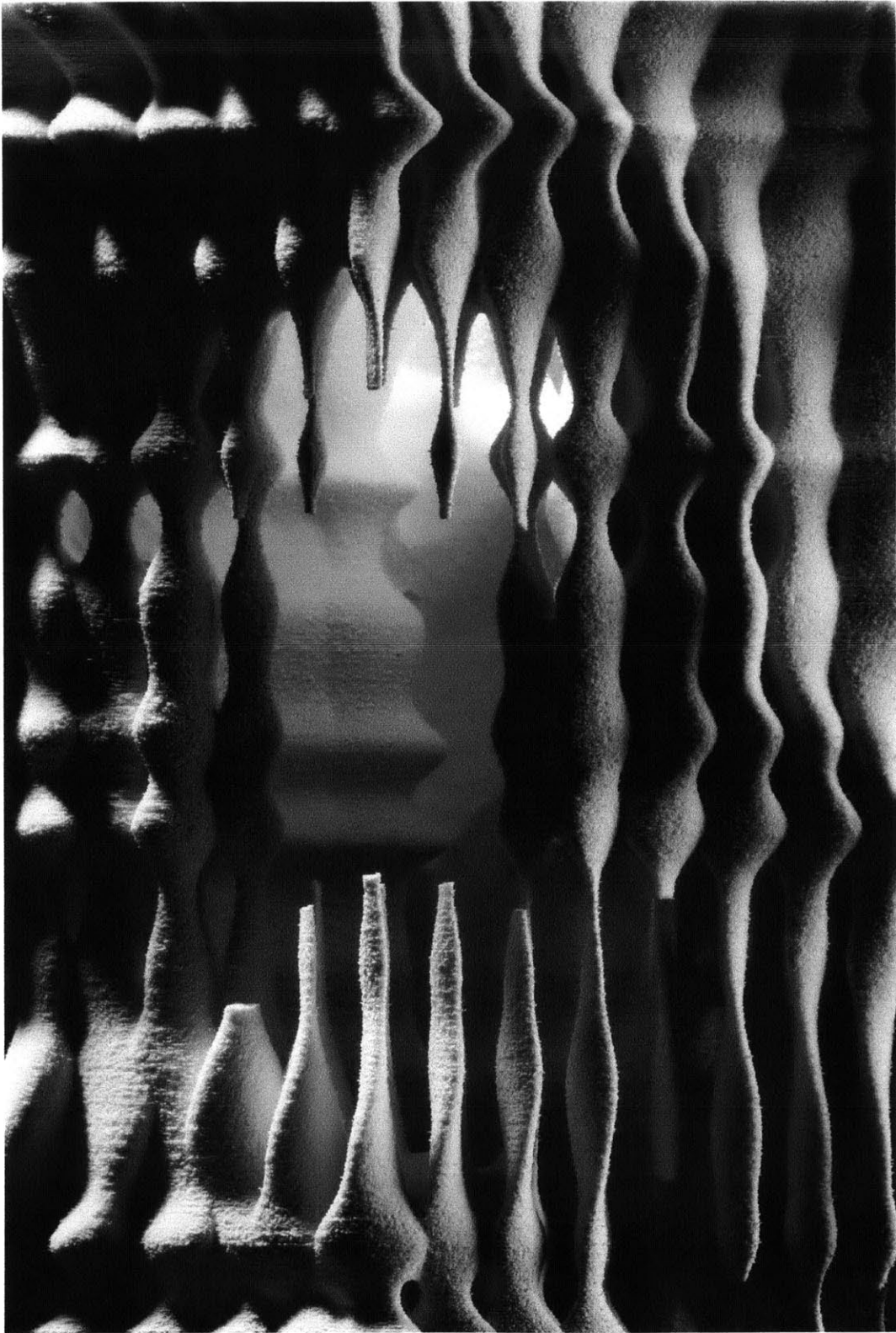


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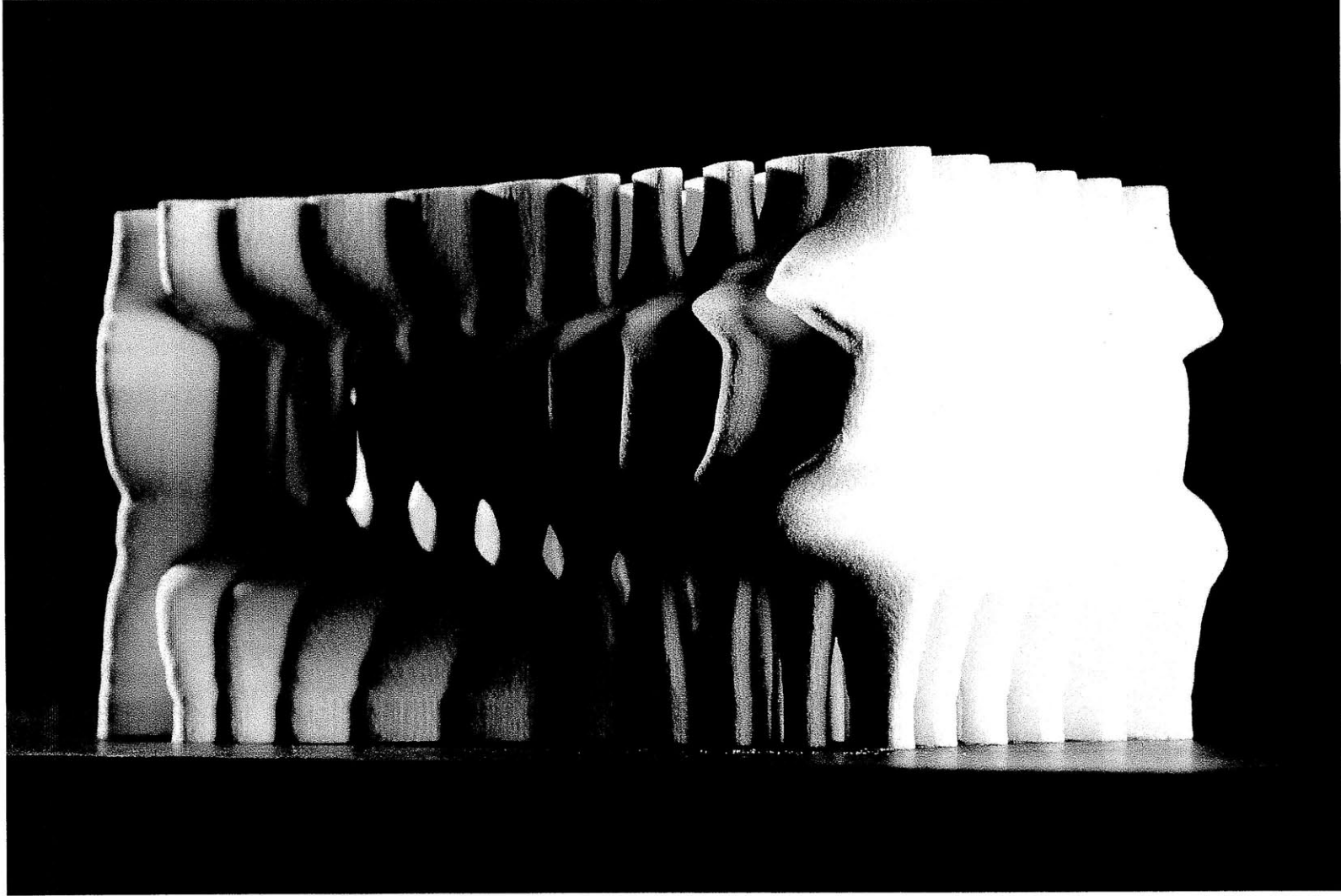


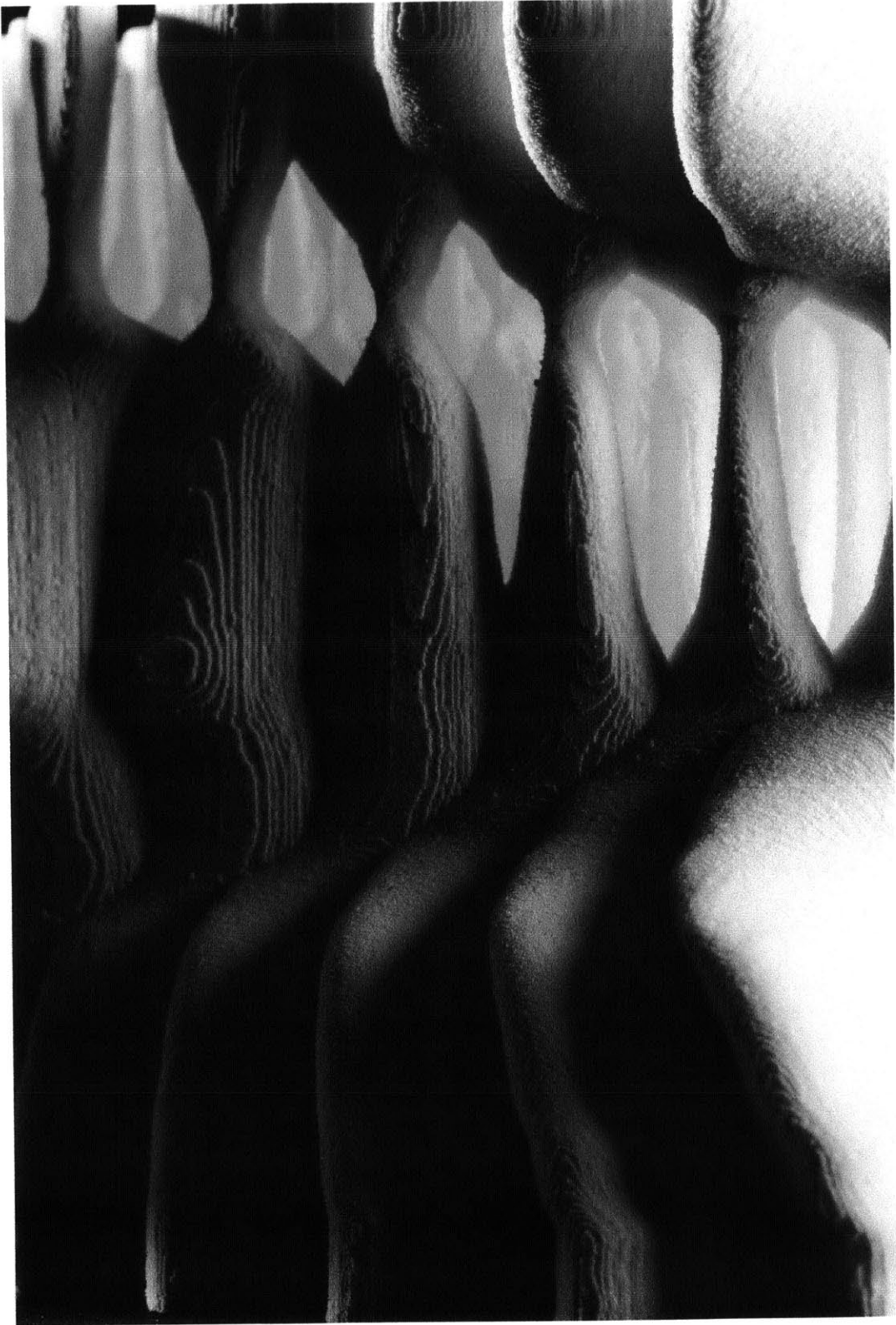
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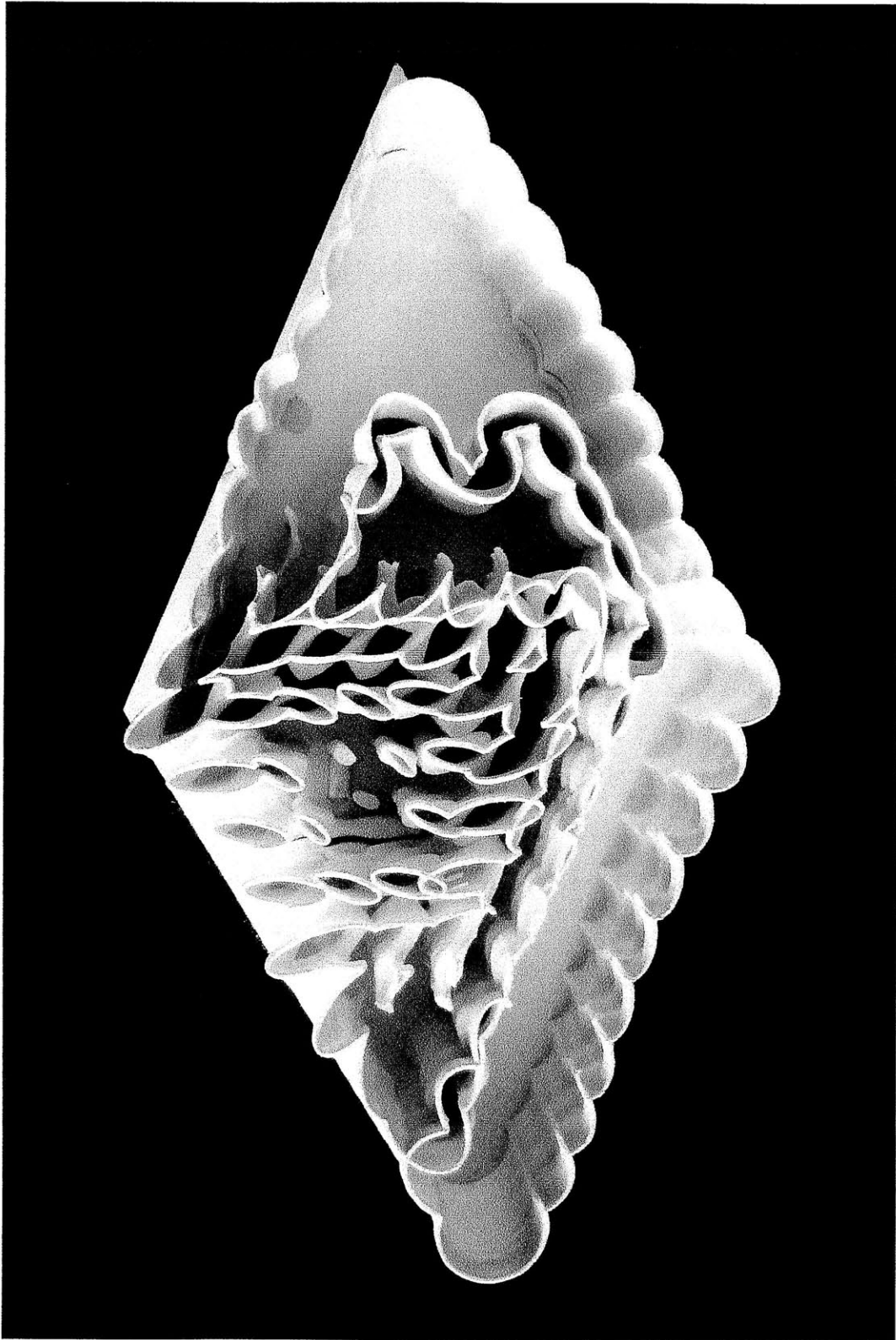


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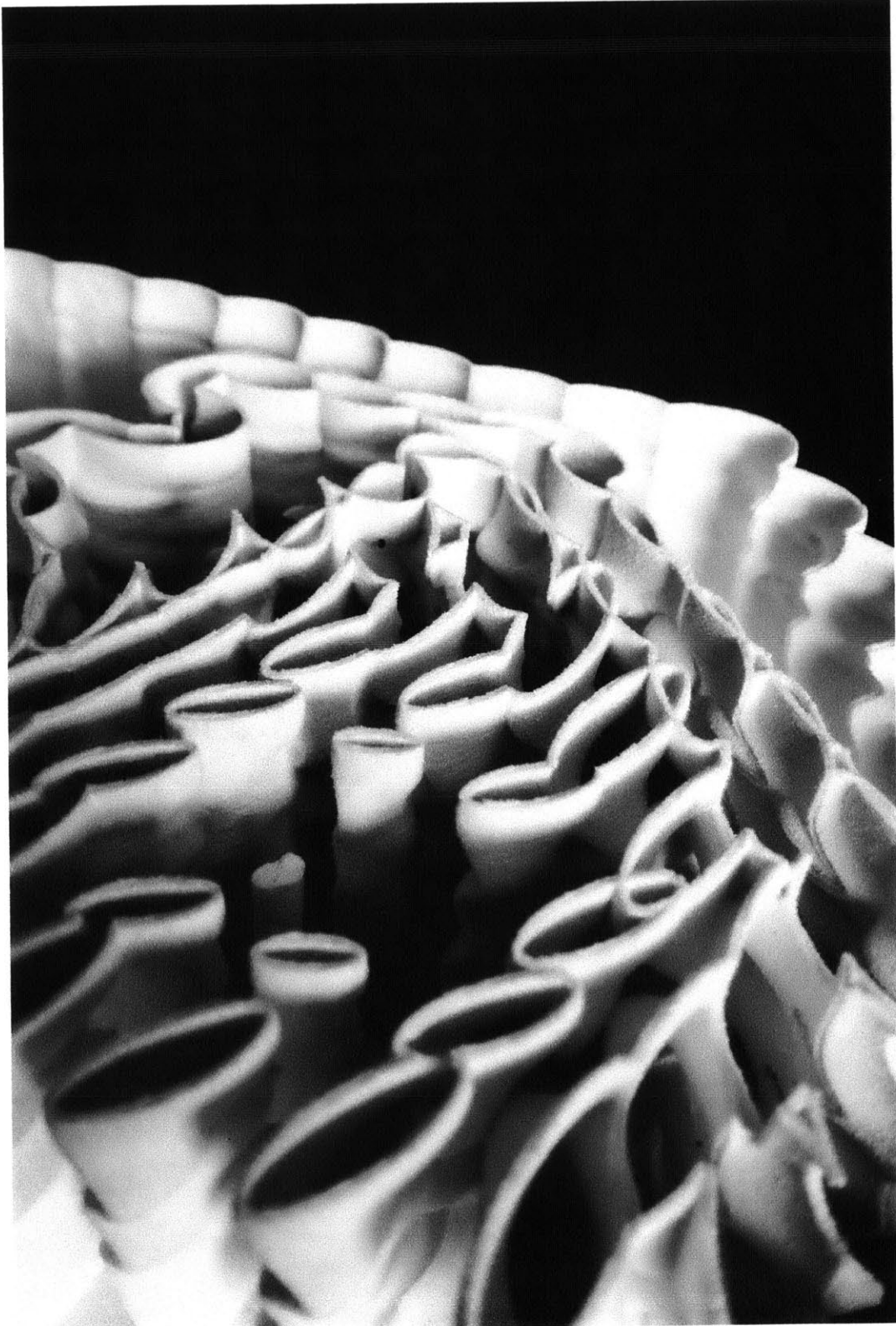




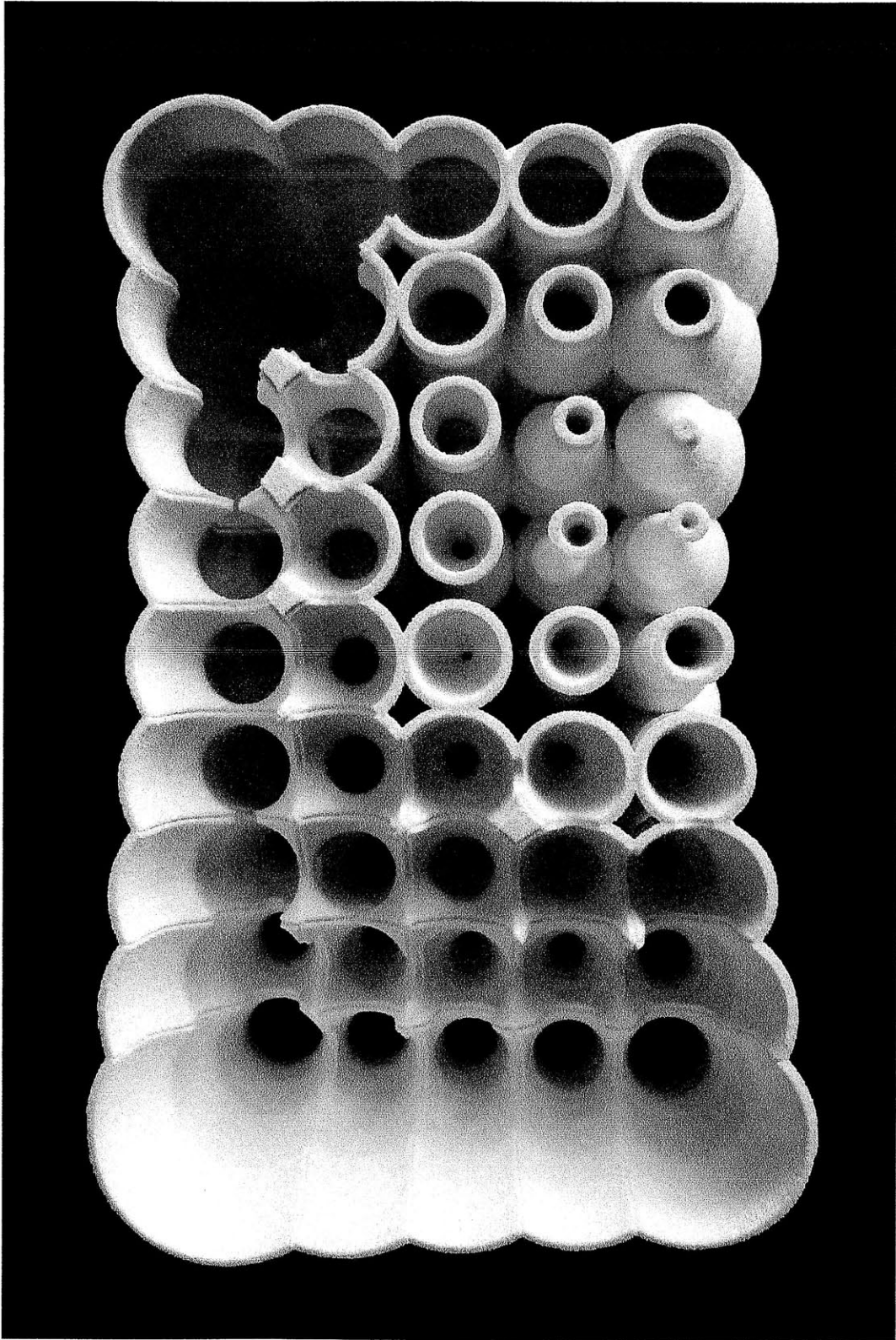
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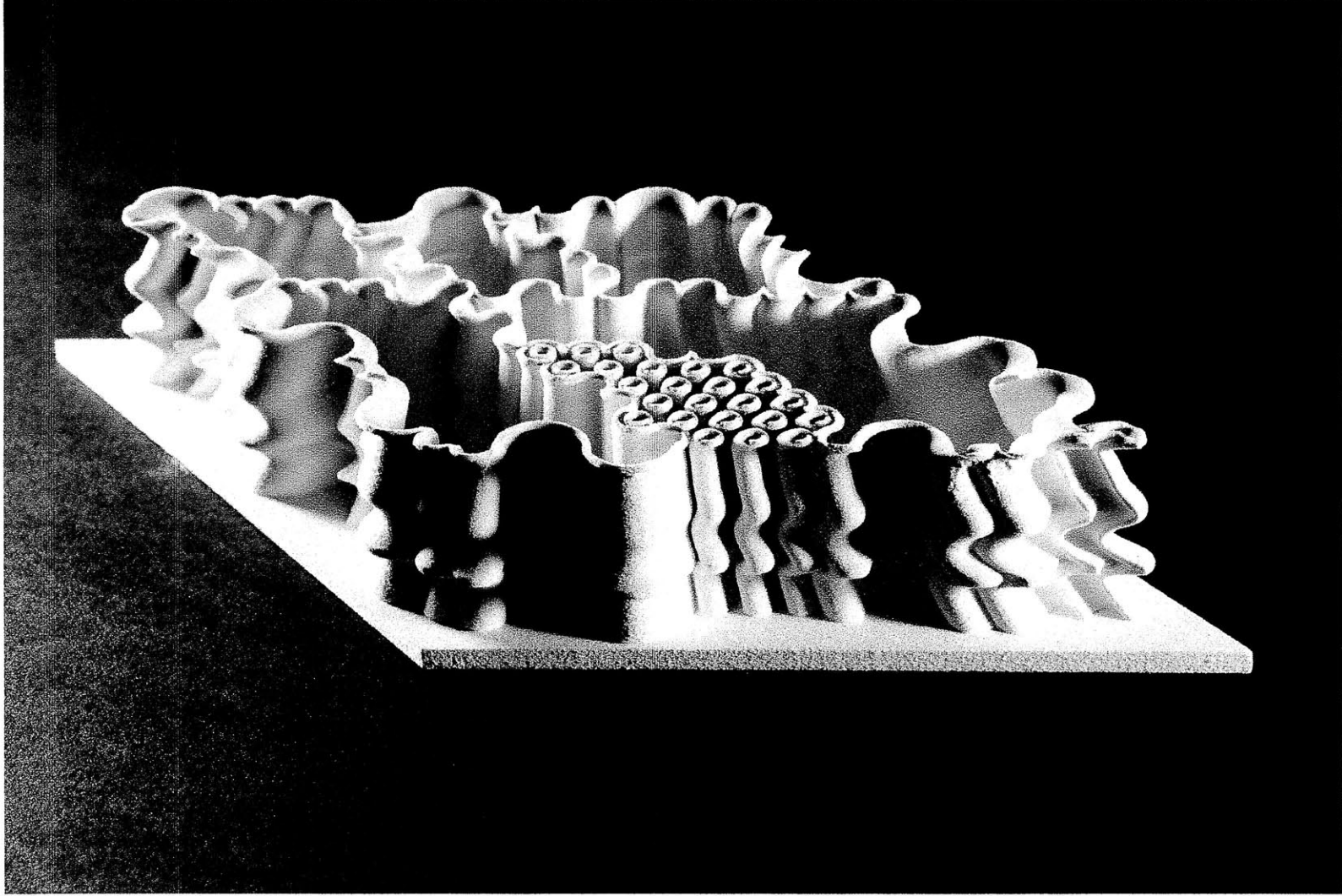


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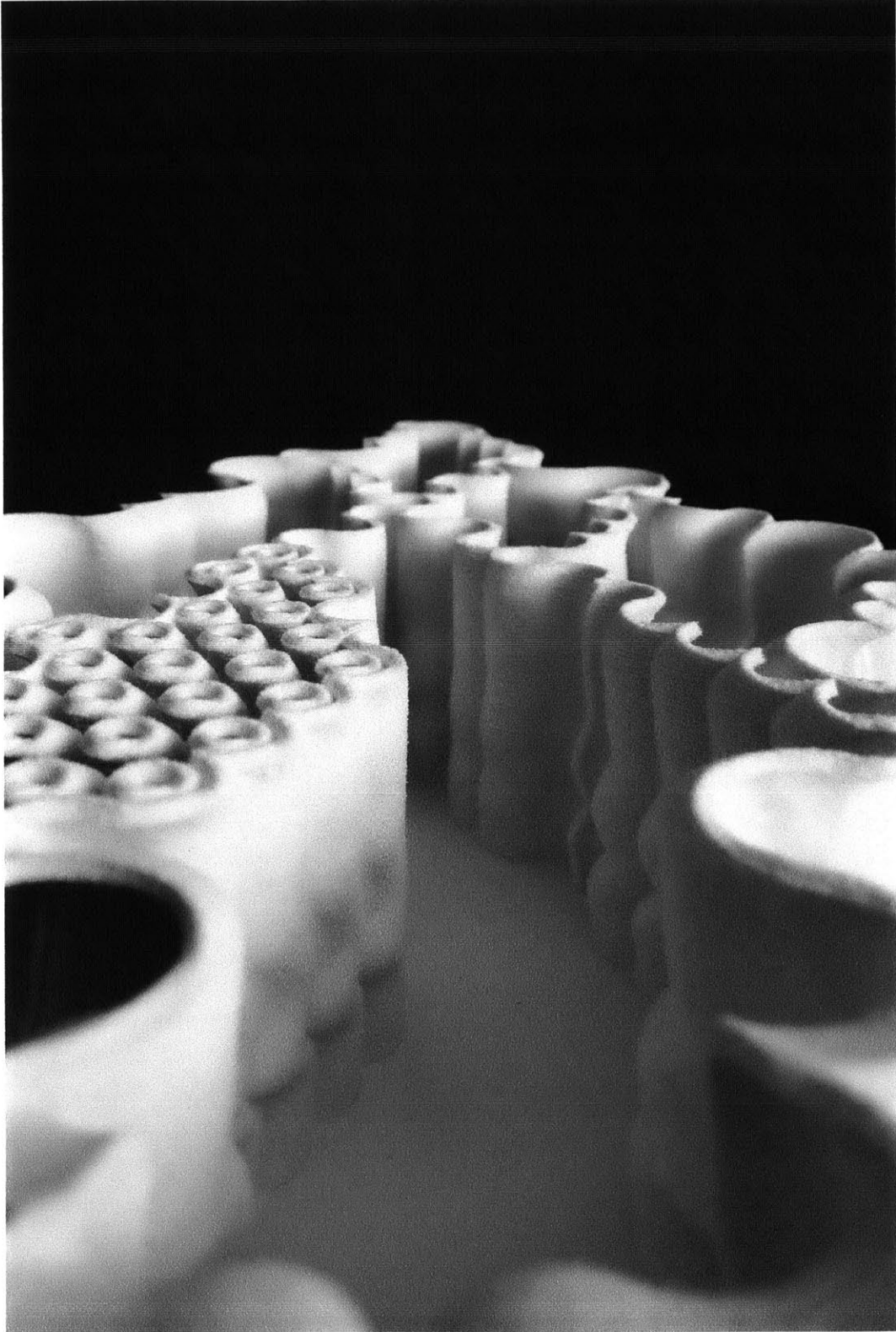
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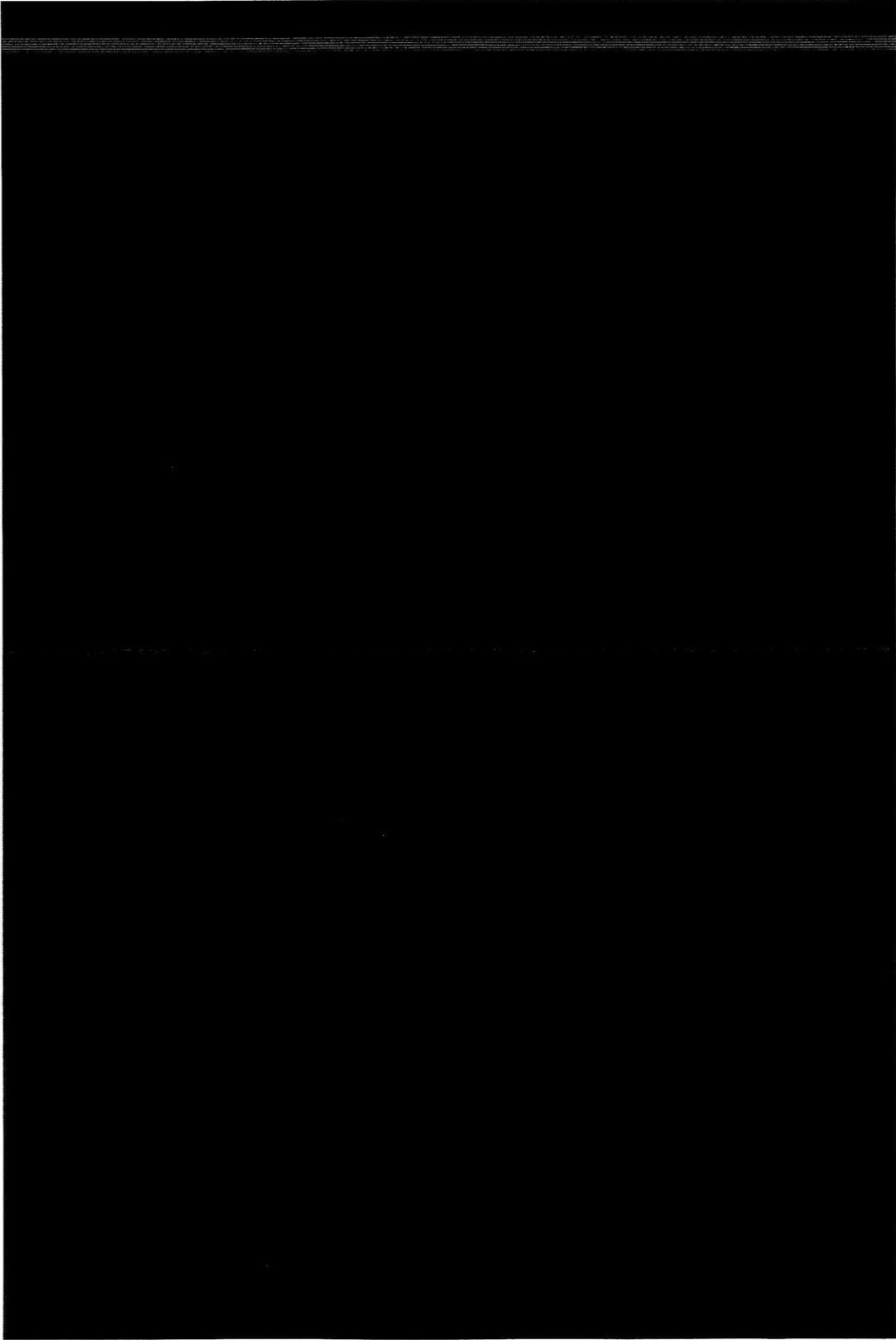


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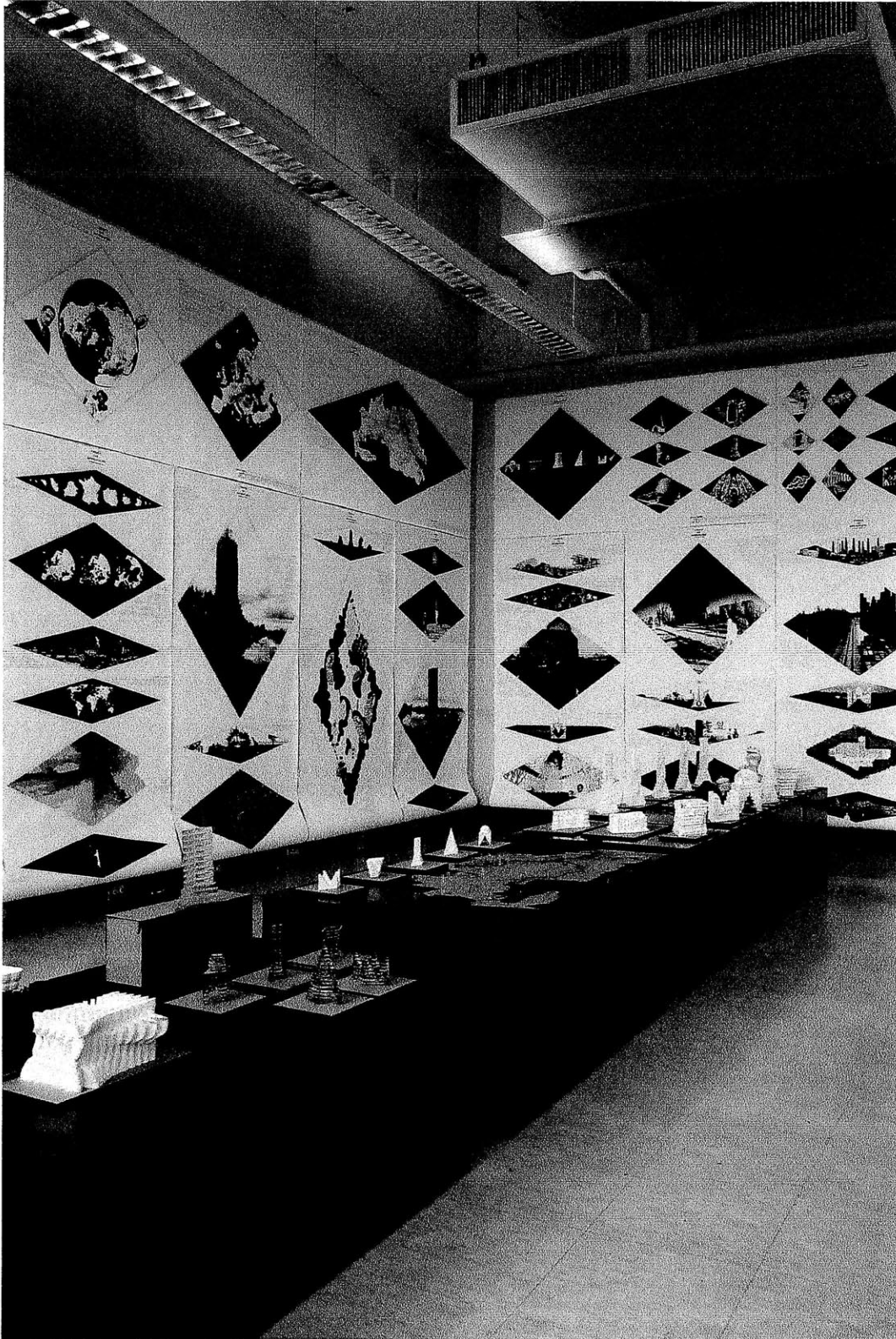
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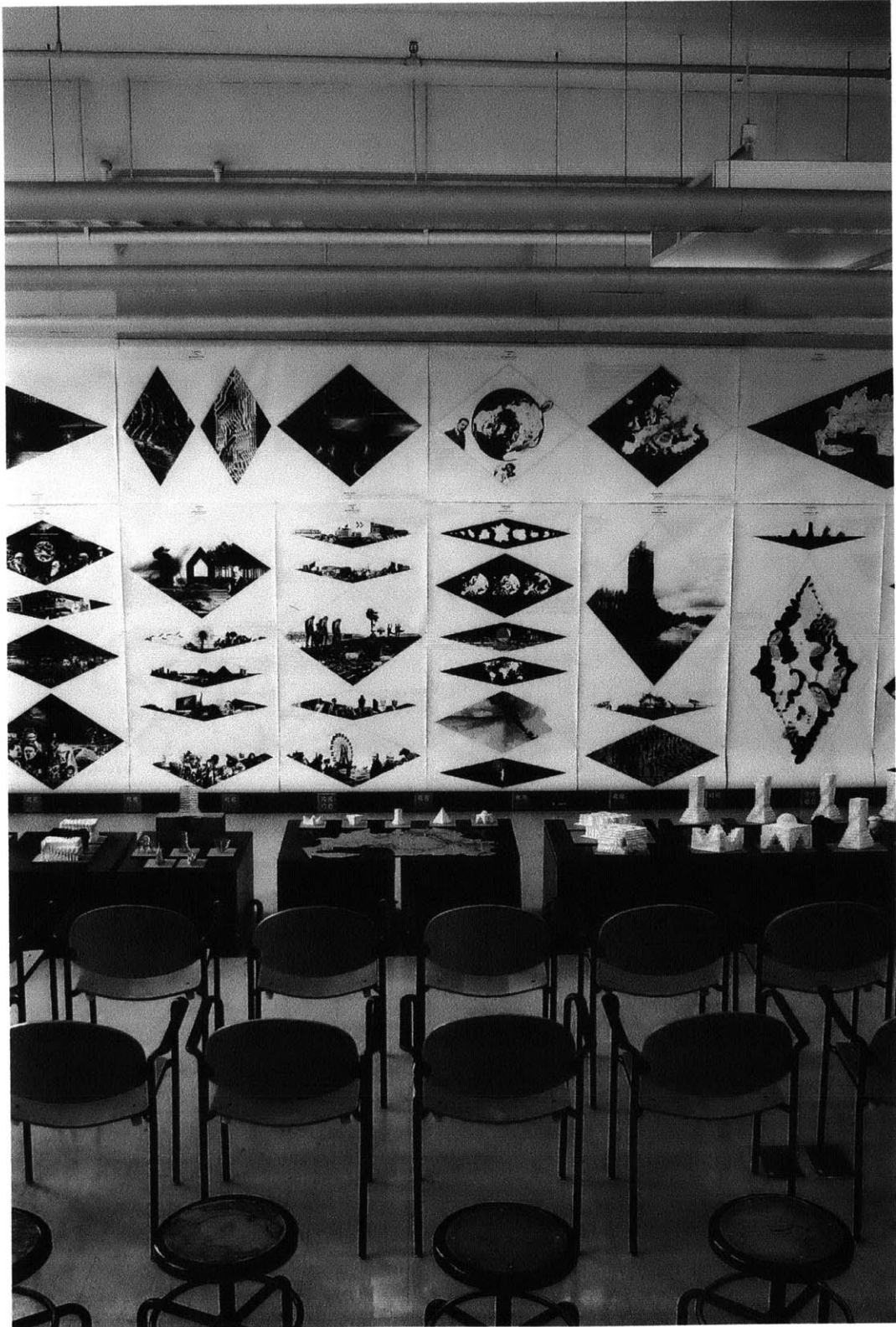


Chapter 01
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01 c . Final Review

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Final Review



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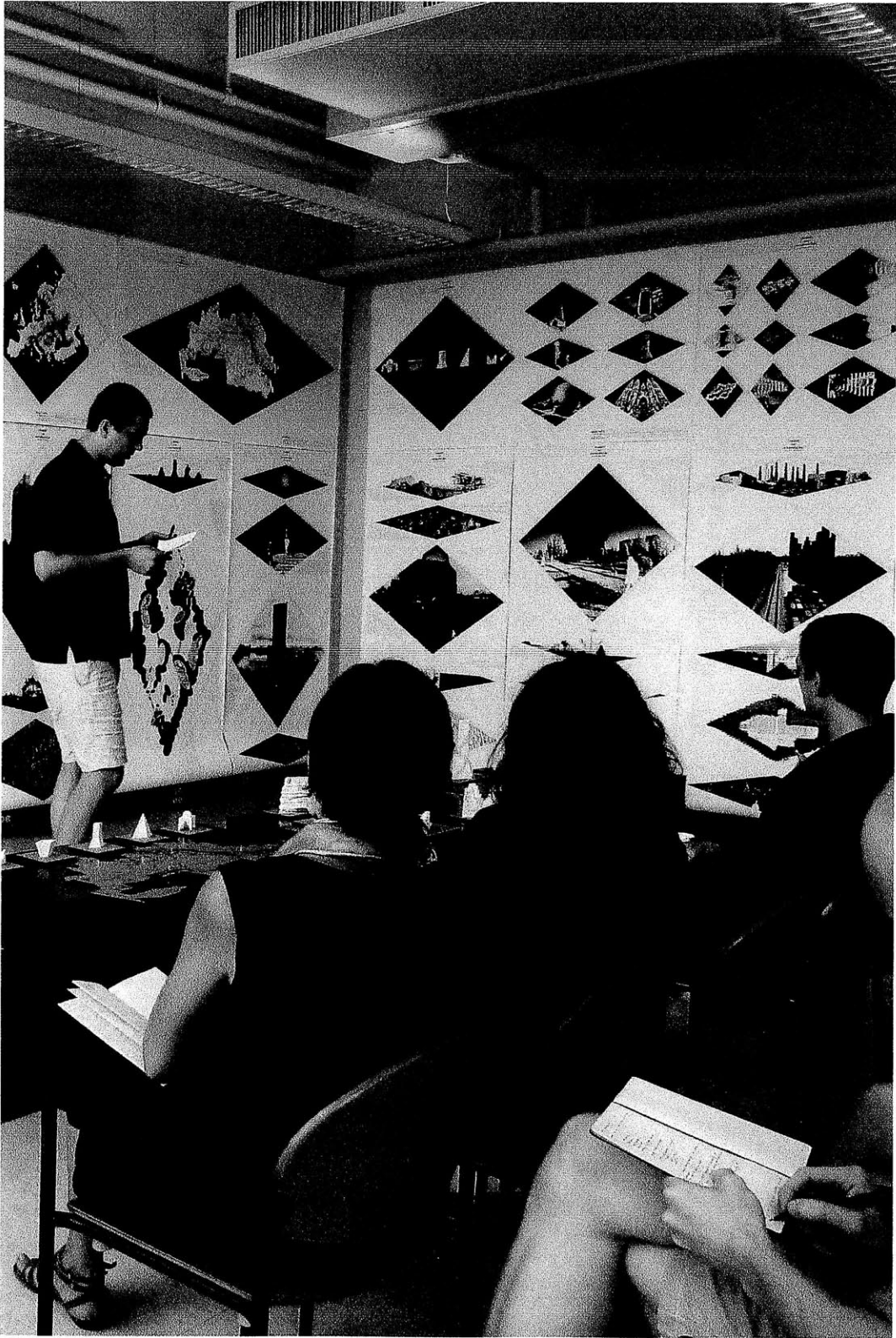
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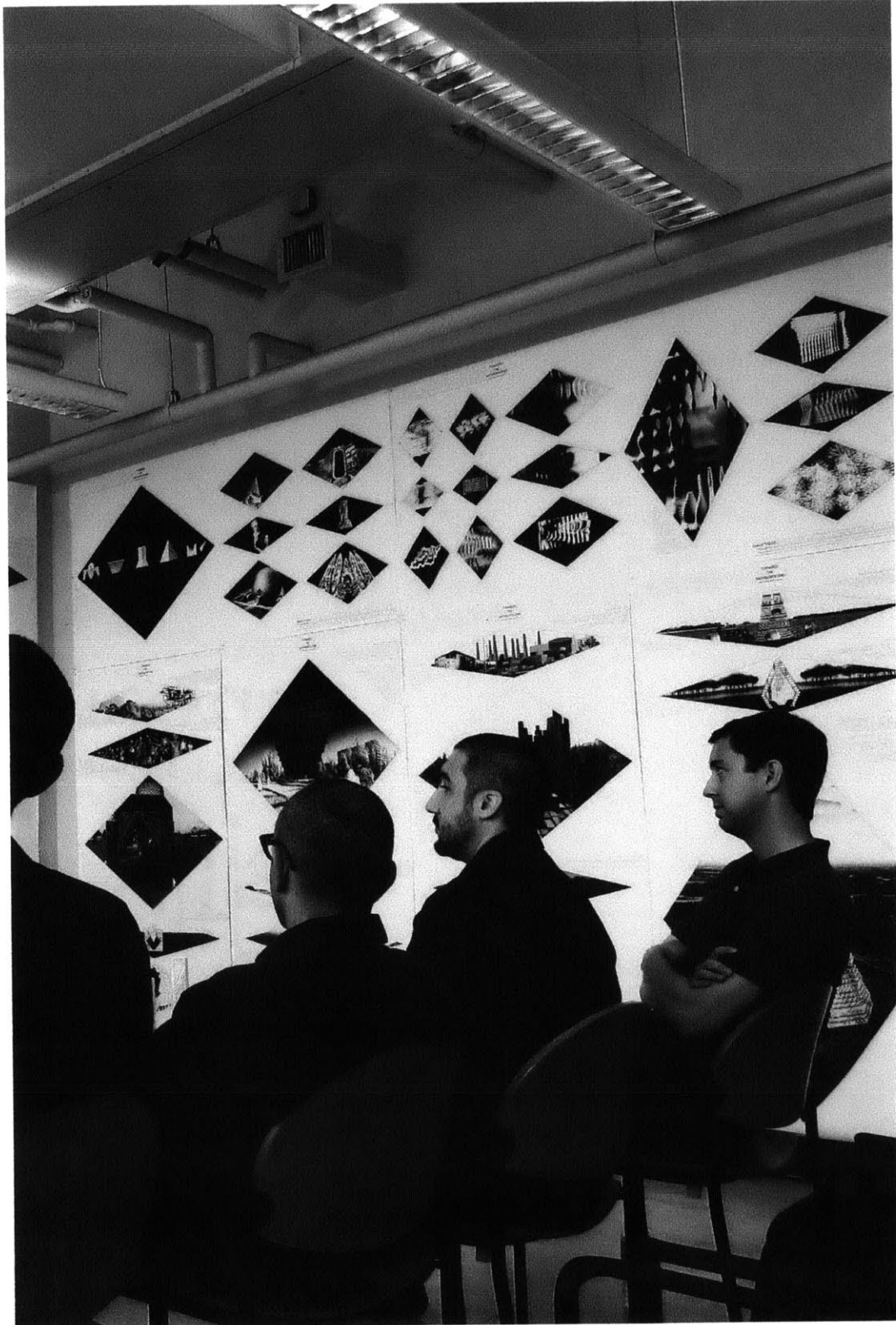
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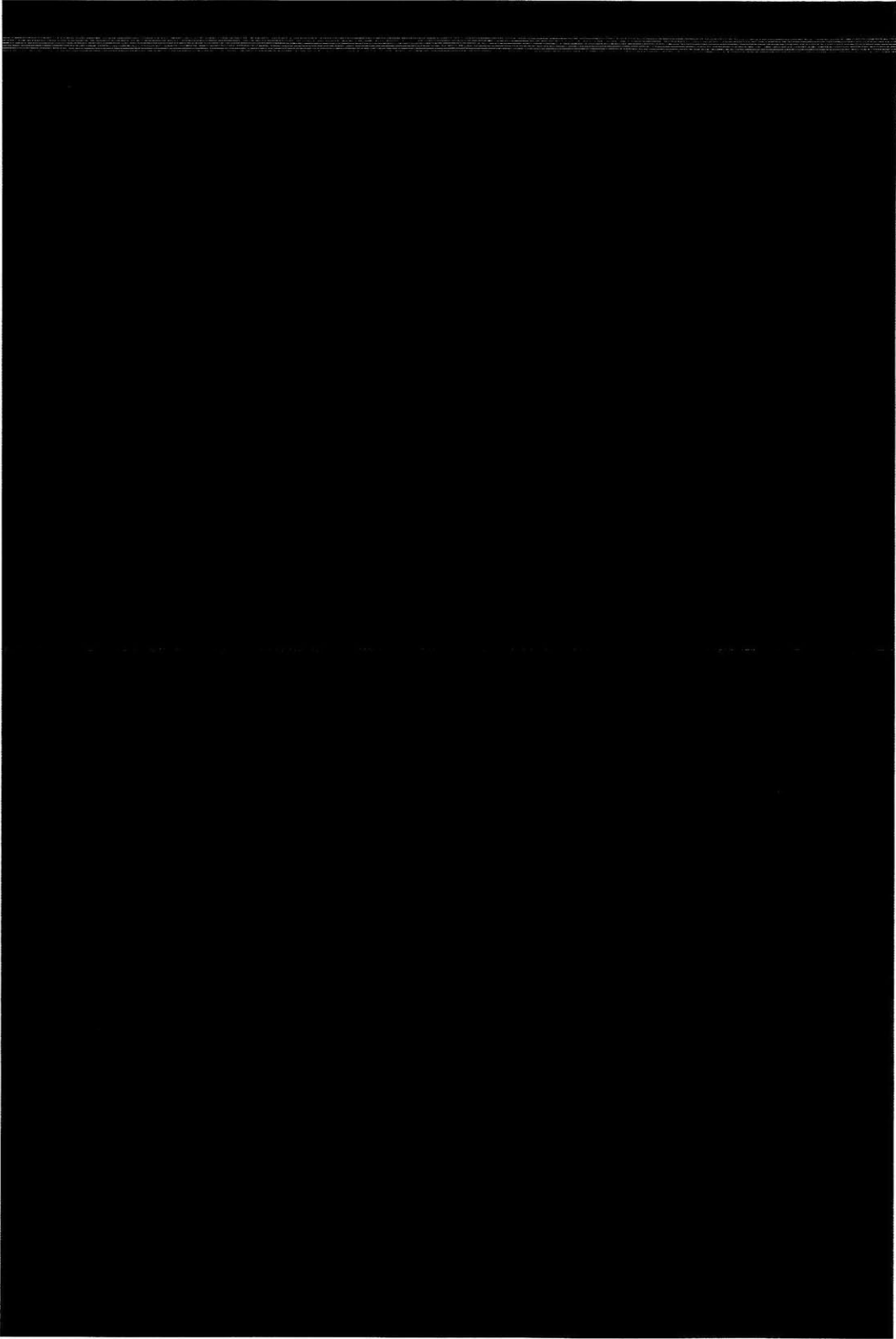
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Thesis Preparation



Chapter 02
Thesis Preparation .
02 a . Research Essay

Towards the Anthropocene . Sasa Zivkovic . MArch . MIT
Thesis Preparation . Abstract



Chapter 02

Thesis Preparation .

Discourse and Debate

ABSTRACT [THESIS PREPARATION]

Geology is in a state of perturbation! Do current levels of human intervention on Earth justify the proclamation of a new geological era: the Anthropocene? "Can toxicity be measured in most layers of bedrock on the planet? Is declining biodiversity a geological concern? Don't we humans need more substantial intervention to be declared as geological force? What about earthquakes, volcanoes and meteorites?" Presently, geologists cannot find consensus regarding the validity of the made claim, yet, even without scientific validation, the idea that, now, after biology, ecology and the environment, even geology is about to lose its virginity and aura of purity is indeed (mildly) shocking.

Entering a realm of scientific uncertainty and discourse, this thesis argues that, the conceptualization of the Anthropocene (as a product of human ubiquity) yields the premise to summarize and critique a whole number of recent influential paradigm shifts and theoretical frameworks in architecture, which, in essence, address the relationship between 'man-made' and 'natural' systems. This includes - but is not limited to - contemporary 'turns' and 'return(s)' towards biology, linguistics, cybernetics, digital production, chemistry, landscape, nature, sustainability, meteorology, environment or ecology. This thesis does not state to address all of the above concerns but will attempt to focus on landscape, ecology, cybernetics and environment (if such categorization makes any sense at all has to remain undecided at this moment - I am also aware that the shortened list is, in itself, ridiculous). In the process of interpreting architectural implications of anthropocene mechanisms, past assumptions and ideologies will be questioned, revealing that new organizational consequences result from rethinking former 'Holocene principles'. For example, hybrid orders between 'natural' and 'man-made' systems will become common ground, architecture will regain autonomy over 'environment', and ultimately, - to paraphrase Bruno Latour - "Nature' will give up the ghost".

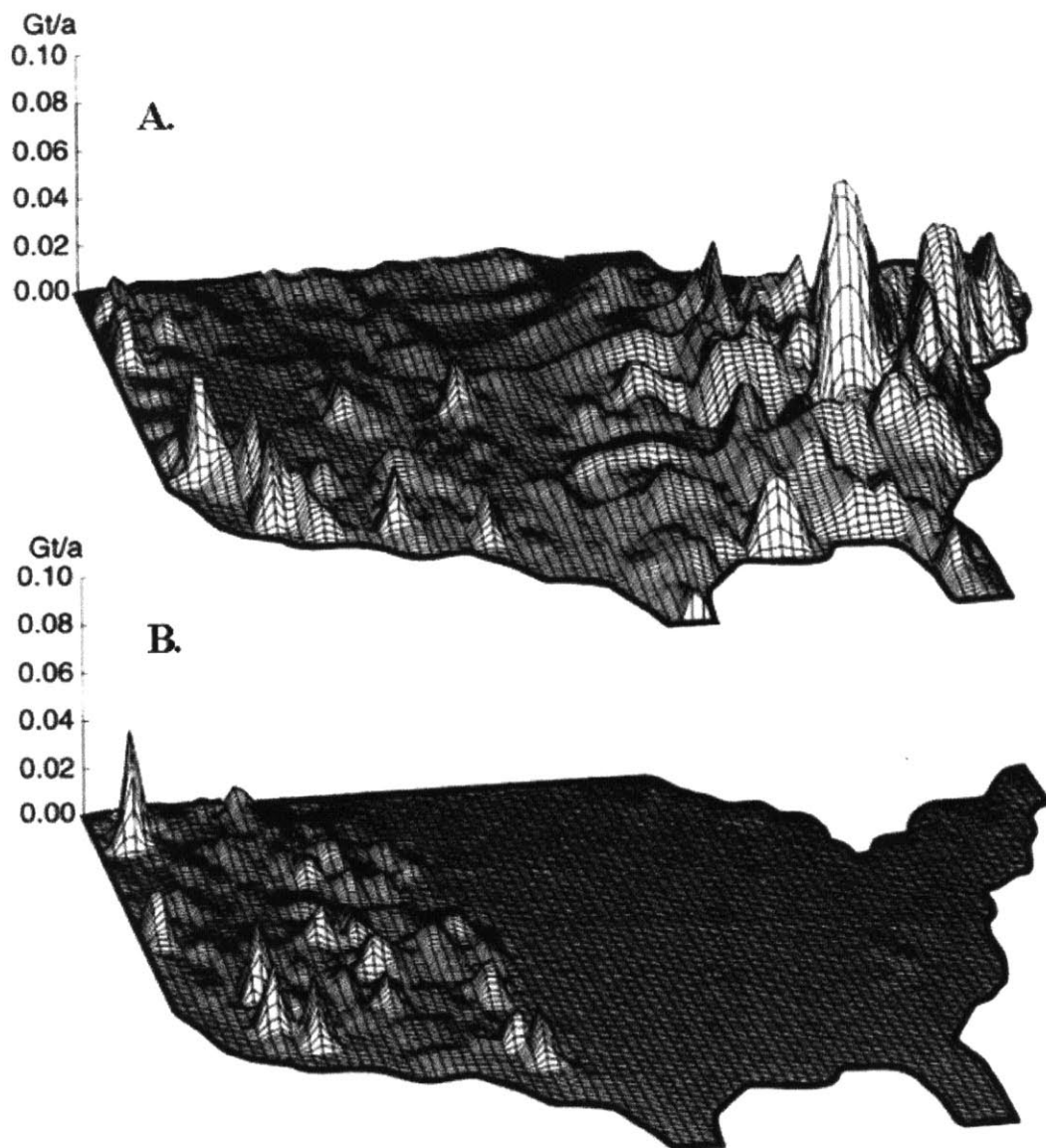
The main hypothesis of this investigation is based on the assumption that principles of contamination (states of disorder) will replace principles of natural preservation (seemingly ordered states) as the new "primary vessel of meaning"¹ for the production of anthropocene environment, architecture, ecology, society, and culture ("nature-culture collectives")². Adapting processes of contamination as new architectural designators will prompt a redefinition of architectural ephemerality towards acknowledging the role of hybrids and collectives in the formation of temporal processes. As the boundar-

Thesis Preparation . Abstract

ies between the 'man-made' and 'natural' begin to blur, the 'temporal' will become a state of being for the new synthesis, revealing a strong reciprocity between formerly disconnected systems. Ephemerality becomes a colossal task: it sets the common ground for all nature-culture collectives. Within temporal processes of exchange, conflicting agendas meet, clash and overlap. The ephemeral is the playground of the anthropocene architect!

The architectural exploration which will be conducted as part of this study borrows ideas from cybernetics, extending the potential of feedback into the formation of temporal relationships between geometries ('buildings/algorithms') and milieus ('natures/environments'). Growth processes, the result of a coupling of 'milieus' and 'algorithms' will be utilized to enhance, modify, alter and control reciprocity between 'man-made' and 'natural' systems.

While the ambiguity and ubiquitousness of contamination might not necessitate an idiosyncratically toxic site, there yet exist certain tempting places which, in their ability to condensate and enhance anthropocene paradoxes and conditions, manage to overcome their own predicaments such as political 'loadedness', extreme environmental hostility, or 'cultural overuse'. I think that Chernobyl yields great potential for exploring the anthropocene paradigm, precisely because of its predicament of being a catalyst for all things '(un)cultural' and '(un)natural'. This thesis advocates to take advantage of the planned revitalization of the Chernobyl Exclusion Zone by proposing a visitor center, animal shelter, research station and anthropology institute worthy of new geological times!



Anthropocene Mechanisms

Top: soil redistribution in the US by humans
Bottom: soil redistribution in the US by rivers

Source: <http://www.desdemonadespair.net/2011/06/graph-of-day-earth-movement-by-humans.html>

Combined Research Essay

Chapter 01

The man made vs. natural

01 a . Ideology of ecology . Non-natures

Contemporary philosophy has long declared the "Death of Nature"³ - the conception of 'Nature' as a pristine, organic, un-touched and balanced entity (threatened only by human exploitation) should have been rendered altogether obsolete by now. While there seems to be consensus that most places on this planet are influenced and altered by human activity, yet, the 'Myth of Nature' (nature as pristine and balanced entity) continues to survive. A spectre is haunting the debate - unwaveringly persisting that 'Nature' is the pure, green, good and happy counterpart to our obscene, dangerous, gray and destructive society. Slavoj Zizek labels this thinking a "mystified, false and dangerous ideology of ecology"⁴: A quasi-religious obsession with a fictitious image of nature. Thinking about the current ideology of ecology, Zizek declares the death of nature: "There is no nature. Nature is not a balanced totality which we humans disturb; nature is a big series of unimaginable catastrophes..."⁵ Zizek is not alone with his assessment, for Bruno Latour states: "When the most frenetic of the ecologists cry out, quaking: "Nature is going to die," they do not know how right they are. Thank God, nature is going to die. Yes, the great Pan is dead. After the death of God and the death of man, nature, too, had to give up the ghost."⁶

A mystified reading of ecology and nature has 'contaminated' contemporary debate in architectural practice and academia. The disciplines' mainstream reactions to climate change and global warming are based on a backward ideology of natural preservation. Falling into the spectre's trap of natural preservation are 'feel good basics' such as 'sustainable design', environmental friendliness, LEED Platinum certificates, or elaborate ARUP energy concepts. The problem here lies in the initial assumption that 'Nature' (the mythical kind with a capital N) has to be preserved and protected in all its pristine greatness. Yet, the belief in a pristine and great 'Nature' constitutes a fallacy - such nature does not exist; it never has existed anywhere other than as a myth. There is a new common ground; we have to break away from past nature-ideology. In architectural discourse, 'decontamination' of past nature-ideologies is beginning to pick up speed. Architects and theoreticians are dismantling 'Nature' on all fronts: from Mark Jarzombek's cultural critique "Eco Pop"⁷ to David Giessen's obsession with "Subnatures"⁸, nature and the ideology of ecology are under close scrutiny.

01 b . Hybrid natures . Hybrid territories

Thesis Preparation . Combined Research Essay

In "We have never been modern", Bruno Latour places the split between nature and society at the core of the "modern constitution"⁹ According to Latour, the base for all Moderns is an absolute distinction between 'Nature' (even though we construct nature it is not our construction) and 'Society' (even though we do not construct society it is our construction). Living comfortably with this divide was possible until suddenly,"[...] we find ourselves invaded by frozen embryos, expert systems, digital machines, sensor equipped robots, hybrid corn, data banks, psychotropic drugs, whales outfitted with radar sounding devices, gene synthesizers, audience analyzers, and so on, when our daily newspapers display all these monsters on page after page, and when none of these chimera can be properly on the object side or on the subject side, or even in between, something has to be done."¹⁰

Latour suggest the development of a new constitution in which "Nature and Society are not two distinct poles, but one and the same production of successive states of societies-natures, of collectives."¹¹ This idea takes into account that half of politics is in fact constructed in science and technology while the other half of nature is constructed in societies. In the end, nature is not only dead, it is replaced by a collective society-nature, a hybrid, in which everything 'natural' comes equipped with the matching 'cultural'- and vice versa. (The bird comes equipped with its ornithologist, the weather with its meteorologist, the melting pole ice cap with its Nobel Prize winning politician, etc.). In architecture, nature-culture hybrids like Gage Clemenceau's "Bio-prosthetics"¹², Liam Young's "Specimens of an unnatural History"¹³, or R&Sie(n)'s "Mosquito Bottleneck"¹⁴ have revived debate about collectives. It seems that in contemporary practice, the interest in hybrids parallels the rise and advancement of digital technology, making it easier to visually simulate natural complexity. The supposedly new 'avant-garde' has yet to prove that it is able to move beyond a semiotic, 'gimmicky' reading of hybrids. To un-gimmick hybrids might require a stronger shift in scale towards hybrid territories as well as a more expansive elaboration of hybrid cultural effects.

01 c . Anthropocene territories

The 'death of nature' and the establishment of a 'society-nature' hybrids are in concert with a broader paradigm shift in the discipline of geology. Since 2008, ecologist Eugene Stoermer and Nobel Prize-winning atmospheric chemist Paul Crutzen have advocated for instituting a new geological cycle: the current Holocene is presumed to be replaced by the Anthropocene (anthropo- meaning 'human' and -cene meaning 'new')¹⁵ to reflect that humans have become a measurable geological factor in Earth's history. Today, climate change, loss of biodiversity, sea level rise, intensive agriculture and changes in the atmosphere are all

Thesis Preparation . Combined Research Essay

registering in Earth's geology. Yet, modification of the environment by humans is not a novel or uniquely modern phenomenon. Some geologists argue that the Industrial Revolution marks the beginning of the Anthropocene, others advocate for the Agricultural Revolution which started about 8000 years ago. Either way, the Anthropocene has already begun, although it has been manifested only recently.

If one considers architecture to be "situated between the biological and the geological – slower than living beings but faster than the underlying geology" (Stan Allen)¹⁶, the conceptual implications of an anthropocene age for the discipline of architecture are substantial. The last citadel of 'Nature' has fallen as humans are now in control of the ground; transformation towards a hybrid state of anthropocene logics has begun.¹⁷ Novel definitions of formerly familiar holocene categories such as 'biological', 'natural', and 'geological' will require an architectural paradigm shift to accommodate hybrids or collectives. In the Anthropocene, the relationship between the 'man-made' and the 'natural' will be questioned and challenged radically: in the end, anthropocene territories will require anthropocene architectures.

Chapter 02

Contaminated environments

02 a . Toxic territories . 'Matter out of place'?

Toxicity is causing a paradigm shift away from 'mythical natures' towards anthropocene territories. Notably since the Industrial Revolution, toxicity has become a 'natural' part of our environment; to the point that "for the first time in the history of the world, every human being is now subjected to contact with dangerous chemicals, from the moment of conception until death."¹⁸ The 'myth of nature' has long been disenchanted by pollution. This process of disenchantment allows for a redefinition of 'society-nature collectives': Bridging the social and the natural-toxic, Ulrich Beck has recognized the broader social implication of pollution when he made the claim that "poverty is hierarchic,[but] smog is democratic."¹⁹ In that sense, pollution can be understood as the new unifier of our "Risk Society". Dust covers queens, factory workers, prime ministers, bums, presidents, prostitutes, movie stars, and dictators. Toxic territories are potentially democratic territories.

Yet, historically, pollution tended to work the other way: Sanford Kwinter states that "ideas of contamination, [...] are by all accounts endemic to human societies since their earliest beginnings"²⁰ Here, Kwinter refers to the idea of social impurity and symbolic realities in the context of dirtiness and contamination. Ac-

Thesis Preparation . Combined Research Essay

According to Kwinter, conceptually, contamination serves to “maintain moral and social order”. Hence, in the social context, contamination constitutes the foundation of an anti-democratic, hierarchic caste society. Yet, this seemingly ‘social lowlife’ -the ‘dirty’ and ‘contaminated’ – manages to challenge existing law and order: “Dirt is a disorder that threatens an existing or even emerging pattern, a formlessness that threatens form”.²¹ In this sense, dirt is a potential catalyst for rebellion. It is “matter out of place”²² which de-territorializes existing orders and organizations. This is true for both, architectural organizations as well as socio-political orders. Current environmental unrest in China, for example, is seen as the greatest threat for the Chinese political system by its government: Hu Jintao knows that “without stability, nothing can be accomplished.”²³ Dirt endangers the status quo. In architecture, dirt questions the modern paradigm for a clear separation between man-made (architectural) and natural (landscape) systems. Framing the landscape in a Corbusian manner and declaring it a hybrid won’t suffice anymore as the distinction between nature and society continues to blur. In the Anthropocene, architecture and landscape merge - dirt is the cement which holds the two together.

02 b . Fear of contamination . The aesthetics of anxiety

“Dirt of any kind seems to us incompatible with civilization; we extend our demands for cleanness to the human body also, and are amazed to hear what an objectionable odour emanated from the person of the Roi Soleil”²⁴ In the most extreme case, the rejection of dirtiness can lead to a complex fear of contamination. Howard Hughes, for example, suffering from obsessive-compulsive-disorder (OCD) was unable to leave his house, concealing himself in a germ-free environment avoiding to touch anything or anyone.²⁵ The social and physical fear of contamination is a strong subconscious influence in how we approach toxic territories. In “Warped Space”, Anthony Vidler describes fear, anxiety, estrangement and their psychological counterparts, anxiety neuroses and phobias as a fundamental part of the “aesthetics of space throughout the modern period”²⁶

Modern aesthetics of anxiety and contamination seem reminiscent of military-industrial-dystopian projects. (see: Paul Virilio’s book “Bunker Archeology”²⁷ or Ant Farm’s installation “Clean Air Pod”²⁸). Contamination and related notions of anxiety are equipped with their own, extreme form of aesthetics. Empowered by the advancement of digital modeling techniques, the work of contemporary practices such as R&Sie(n) or Mitchell Joachim (Terraform One) has embraced a dystopian aesthetic of contamination in form of strange, biomorphic, spiky buildings or landscapes reminiscent of tanks, war machines and bunker architecture. The question needs to be raised if contaminated territories really necessitate and justify those aesthetics? It seems that a catchy aesthetic automatism is

being proposed in this context rather than admitting that the turn towards the military-industrial-dystopian marks a conscious, (critique-able) design decision. A rethinking of military-industrial-dystopian aesthetic in the context of building in toxic territories seems imperative.

02 c . Architectural two-folds . Threshold dichotomies

In "Terror from the Air", Peter Sloterdijk discusses "demothization" techniques (getting rid of moths through the use of gas) at the beginning of the 20th century and a parallel emergence of an environmental awareness by questioning the release of toxic substances into the atmosphere: "After [...] the development of environmental awareness, zones emerged in which the relationship between the surrounding air and the contaminated air zone became inverted. In other words, artificially created – or we might now say: the air conditioned - zones emerged which provided privileged air conditions relative to the general surroundings [...]"²⁹ Today, architecture is facing a 'contamination paradox' evolving around the question of 'conditioned environments'. In the not too distant past, buildings only needed to ensure that the interior does not get contaminated by surrounding environmental factors such as air, wind, cold, and sun. Today, environmental awareness has created a paradigm shift, putting emphasis on buildings which attempt to minimize contamination of the environment through the use of environmentally friendly materials or building technology. A building now needs to do both, protect from exterior contamination and protect the exterior from contamination. Paradoxically, 'demothization' is an architectural two-fold: hence, we eradicate 'moth no.1' in the filter of our building's air intake system while making sure to protect it's friend, 'moth no.2' by buying 2x4's from insect-friendly forestry. This logic applies to many processes particularly regarding the architectural envelope. A Passive House, for example, is a hermetically sealed bunker whose only connection to the exterior is entailed by its mission not to have any impact on its surroundings whatsoever.

The contamination paradox around the architectural envelope has further reinforced a historic dichotomy between interior and exterior environments. Only few projects like, for example, FOA's Yokohama Port Terminal manage to successfully establish a more ambiguous reading between interior and exterior spaces, revealing possible spatial and socio-political opportunities in what Slavoj Žižek calls a "Deleuzian poetry of fluid de-territorialization"³⁰. Acknowledging anthropocene logics of contamination, past dichotomies such as the binary between the interior and the exterior need to be questioned. In this context, natural preservation is a false premise and counterproductive even to its own goals (and its naïve interpretation of a balanced relationship between man and nature) for who owns a Passive House bunker has managed to build and live in a diagram

of Latour's modern constitution: chapeau! It truly goes without saying that the past architectural two-fold constitutes a dead-end. Time to move away from binaries...

Chapter 03 **Redefinition impossible?**

03 a . Review of past architectural techno environments

The "Return to nature"³¹ in academia and practice predicates a cyclical phenomenon: In "What ever happened to Ecology", Anthony Vidler describes that architectural ideas relating to environment and ecology had several revivals during the 20th century but that "these successive waves of interest have episodically been lost or forgotten by the mainstream of the architectural profession."³² Current discourse is strongly engaged in reviving the work of Buckminster Fuller, Reyner Banham, John McHale, the Metabolists, the Independent Group, the Droppers, and other key figures of the 1950s and 1960s.³³ The importance of this episode for today's debate lies in its diverse dispute about the role which technology plays in shaping our environment.

"In order to approach the question 'Whatever happened to ecology?', we must survey the battlegrounds of the 1950s and 1960s and the resulting lines drawn between programmers, techno-futurists and formalists"³⁴ With today's means of technology, the battle has reached a new level of complexity. Looking back reveals flaws in current thinking. A sense of urgency towards global environmental problems is not a novel condition. Many seemingly contemporary avant-garde ideas are, in fact, merely recycled 'techno utopian' concepts.

In this context it is interesting to add Bruno Latour's claim that the realization of techno utopias such as the space program caused "the arrow of time" to change its shape and direction back towards the concerns of our planet: "It is hard to imagine that in such a short span of life, the "arrow of time" too has so thoroughly changed its shape and direction. It is not an arrow anymore, targeting some well-accepted goal. It is rather like a plate of spaghetti, zigzagging around without leading in one direction, to one climax."³⁵ It is the first image of the whole Earth captured by the crew of the Apollo 8 mission which led the generation around Buckminster Fuller to focus on 'Spaceship Earth'. Today, the complexity and fragility of our planet's ecology are once more at the center of attention – for different reasons than in the 60's, but nevertheless.

03 b . Politics of neo-natures?

The current debate about 'Nature' questions former concepts of ecology and en-

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vironment. New nature paradigms are emerging: "The manifesto on the third landscape was based on the notion that the undeveloped plot or leftover fragment of the *jardin planetaire* is the refuge of earth's biodiversity, and thus our biological future. Such spaces are found everywhere in the world. Every rural or urban development venture, however technically accomplished and in whatever spirit of land use, generates some wasted space that awaits a future."³⁶ There exist many similar concepts to Gilles Clement's "third landscape". (see: David Giessen's "Subnature", Françoise Roche's "Corrupted Biotopes"³⁷, or Antoine Picon's "Anxious Landscapes"³⁸). Generally, all these concepts share anthropocene ideas about new society-nature relationships. In the case of Clement, the turn towards forgotten and wasted landscapes is also a criticism of the society which initially produced the third landscape. It seems that the third landscape constitutes both, a paradigm shift in how a society views nature, and evaluate its own predicaments. In the end, embracing neo-environments is an act of politics.

Dirt, dust, debris, smoke and weeds are the supposedly new anti-generic. They are architecture's 'punks': un-integrated, kind of cool, a bit dangerous, but fascinating outsiders. Natural leftovers (aka. nature punks) come equipped with their own politics of de-territorialization.³⁹ They oppose existing orders while occupying new territories. Away from mainstream 'Nature' those leftovers establish new relations between society, politics, nature and environment. They are able to critique the conditions which have created them by embracing things which are not part of the polished mainstream of popular culture. Architecturally speaking, this 'Nature Junk' yields the potential to confront generic "Junk Space"⁴⁰ with alternate politics by embracing the "heterotopic"⁴¹ qualities of natural leftovers and 'third landscapes'. Will nature junk, dirt and pollution, - all children of capitalism and consumerism - end up sabotaging and undermining the hard work of their own parents? Are such the politics of the Anthropocene?

03 c . Temporality in times of compromise-ariums?

The discussion about nature and environment has led to a 'meteorology-, climate-, and weather 'hype' in current discourse. Supposedly revolutionary new climatic architecture, "free of formal and functional predeterminations"⁴², emerges from analyzing weather and air flows. We are living in ecological times; today, "form and function follow climate!"⁴³

Climate architecture has many followers: Investigating -ariums⁴⁴, climates and weathers for the wrong reasons (with a mindset of scientific accuracy) has led to an inflationary understanding of architectural temporality. Complex concepts are being dumbed down into architectures of 'radiation', 'evaporation' or 'conduction'⁴⁵. In "Terror from the Air", Peter Sloterdijk claims that we would need a new

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kind of physics to adequately analyze processes which are as complex as the interplay between "the atmosphere (gaseous envelope), the hydrosphere (water world), the biosphere (plant and animal worlds), the cryosphere (the ice regio) [and] the pedosphere (solid land), which, under the influence of the sun's radiation, comprise extremely complex patterns of energy exchange."⁴⁶ Taking this into consideration, it seems ridiculous to assume that meteorological architecture -designed by architects with a mere high school understanding of physics - is anything but - formal predetermination. This work seems far more interesting when viewed as what it actually should be labeled as: a pop-cultural science fiction far away from plain science.

Approaching architectural temporality as a form of 'Science' means to design meaningless compromise-ariums. Today's climactic formalism is nothing but an appendix to 1990s ideas of natural imitation. The lesson learned from the discussion about bio-mimicry in the 90's should have been that biomorphic formalism is NOT equivalent to an intelligent, living, biological system. Yet, climate architecture is rendered as the neutral and organic approach towards design. Interest in environments and biologies is above all a cultural phenomenon born out of an inner desire to connect architecture to nature. But, 2012 is not the 1990's anymore, meaning: no need to justify an interest in voronoi by pseudo-scientifically pointing out their 'bio-efficient structural logic' or to justify an interest in temporality, flows and processes by rendering it 'Science'. "The voronoi is not a virgin scientific object derived from nature, but rather a culture-nature artifact.

Our new culture-nature artifacts (like e.g. the voronoi) are inherently linked to ideas of resemblance, a concept which Michel Foucault describes as the 'episteme' of classical thought. As such, they have the potential to re-introduce autonomy into the discourse about environment and ecology in architecture: "The nature of things, their coexistence, the way in which they are linked together and communicate is nothing other than their resemblance. And that resemblance is visible only in the network of signs that crosses the world from one end to the other. 'Nature' is trapped in the thin layer that holds semiology and hermeneutics one above the other; it is neither mysterious nor veiled, it offers itself to our cognition."⁴⁷ Humans are the producers of nature; in turn, nature does not need to be the sole producer of architecture! A cloud alone makes no building - or, it should not.

Chapter 04
Towards the Anthropocene!

"'Nature' on Earth is already 'adapted' to human intervention to such an extent –

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human 'pollution' being already deeply implicated in the shaky and fragile equilibrium of 'natural' reproduction on Earth – that its cessation would cause cataclysmic imbalance."⁴⁸ (Slavoj Zizek, Living in the End Times)

04 a . Chernobyl – Welcome in disordered territories!

Of all messed-up places in the world, it is Chernobyl which best resembles the paradoxes of the Anthropocene. The 'Chernobyl Exclusion Zone (CEZ)' is a 'man-made', highly contaminated, yet surprisingly 'natural' land of blossoming ecology. It is dangerous, but looks fabulously harmless. Chernobyl is void of people but filled with the remains of their civilization. A democratic neo-environmental "New Babylon"⁴⁹ of total freedom. Tarkovsky's metaphysics of 'The Zone'⁵⁰ come true. Chernobyl is the dystopic utopia for ecologists and environmentalists. A Heterotopia par excellence. The place where nature ideologies clash. A place where architecture seems ridiculous!

Chernobyl spans a territory of disorder in which formerly steadfast predeterminations open up towards new possibilities because of the latent inadequacy to engage in any standard definitions, norms and rules. Yet, this does not mean that an investigation in Chernobyl is irrelevant for other scenarios; Chernobyl is in fact an ubiquitous condition. The CEZ merely manages to enhance states of disorder – rendering them more visible. Chernobyl is a paranoid paradise of opportunity: It produced an environment in which fear of contamination seems so endemic that it might enable the production of novel aesthetics for the uncanny. It is the ultimate test site for contamination-paradoxes, autonomous environments or production of natures. It is the place to test the anthropocene constitution. In Chernobyl, architecture cannot differentiate between 'man-made'- or 'natural' deterritorialization and disorder: Every process is simultaneously natural, man-made, intoxicated, hybrid, static, radioactive, restrictive, politically liberating, and potentially authoritarian.

The downright absurdity of Chernobyl comes with its expansive, intercontinental, de-territorial intoxication of territory. Today, 25 years after the catastrophe, a major part of Europe is still 137-Cs contaminated due to the massive reactor fallout of 1986. Contamination from Chernobyl can be measured in Canada, Japan and probably even in the International Space Station. Many places outside the CEZ are actually more contaminated than sites in immediate vicinity to the reactor. Any project in a European context, might address the same site specific issues of a project in Chernobyl. The CEZ constitutes a conceptual as well as physical reality which reaches far beyond its little 30 kilometer Exclusion Zone. Remote contamination is toxic de-territorialization at its best. Welcome to the Anthropocene! Welcome in disordered territories!

04 b . Colossal ephemerality . The Anthropocene nomad

If one assumes that principles of contamination will become the new “primary vessel of meaning”⁵¹ for the production of anthropocene environment, architecture, ecology, society, and culture (“nature-culture collectives”⁵²), then, understanding the reciprocity of processes in which those systems exchange and influence each other is a way to regulate and take authorship over what is currently acknowledged only as a passive by-product. Adapting processes of contamination as new architectural designators will prompt a redefinition of architectural ephemerality towards acknowledging the role of hybrids and collectives in the formation of temporal processes. In the Anthropocene, architectural ephemerality is both, a result and reaction to temporality. In the end, ephemerality becomes a colossal task: it sets the common ground for all possible nature-culture collectives. Within temporal processes of exchange, conflicting agendas meet, clash, conflict and overlap. The ephemeral is the playground of the anthropocene architect!

If anything, the ‘natural’ and the ‘man-made’ are related through an incredibly complex system of feedback loops resulting in a variety of social, ecological, political and environmental temporalities. Ultimately, temporal processes (‘cultural’ as well as ‘natural’) have to be rethought in terms of authorship and autonomy. Deleuze and Guattari raise the question about the autonomy of the nomad and his relation to ephemerality: “The nomad has a territory; he follows customary paths; he goes from one point to another; he is not ignorant of points (water points, dwelling points, assembly points, etc.). But the question is what in nomad life is a principle and what is a consequence. [...] The water point is reached only in order to be left behind; every point is a relay and only exists as a relay. [...] The nomad distributes himself in a smooth space; he occupies, inhabits, holds that space; that is his territorial principle. It is therefore false to define the nomad by movement; it is profoundly right to suggest that the nomad is on the contrary he who does not move.”⁵³ For the Deleuzian nomad, temporality is a state of being (for the contemporary architect, temporality is a state of panic and hysteria). When speaking of temporality, autonomy and authorship can only come from ‘not moving’ too much. We need to ask: If the Anthropocene is the principle, what is the consequence for architecture?

04 c . And now?

Manifesting a singular, unified architectural anthropocene destiny is as naïve as hoping that other forms of organizing environment, ecology or territory can “guarantee an open society or equality in politics”. “While there are constraining architectures, there are no specifically liberating architectures:

'Liberty', [Foucault] says, 'is a practice.'⁵⁴

Remains only to continue dealing with a diverse "spaghetti" of systems, networks, ecologies, natures, hybrids, and bio-morphisms. Yet, this time acknowledging a significant (maybe revolutionary) change of principle: the paradigm shift towards the Anthropocene.

1 Koolhaas, Rem in Scott, Felicity D. Architecture or Techno Utopia – Politics after Modernism. The MIT Press. (2007, Cambridge, MA) pp. 263

2 Latour, Bruno. We have never been modern. Harvard University Press. Cambridge. 1993 pp. 49/50

3 Zizek, Slavoj. "Examined Life" last modified 10 October 2009. Zizek, <http://www.youtube.com/watch?v=iGClv1xt0U>

See also references to Latour, Buell, Beck, Jarzombek and other references to this paper. Zizek points out that "nature is a series of mega catastrophes". Nature is not nice to begin with: meteors, mass extinction, ice ages, toxic volcano eruptions happen "naturally".

4 Zizek, Slavoj. "Living in the End Times according to Slavoj Zizek" last modified 11 March 2010. <http://youtu.be/Gw8LPn4irao> Zizek talks touches upon this in his book as well: Zizek, Slavoj. Living In The End Times. Verso (2010, London)

5 Slavoj Zizek, "Examined Life" last modified 10 October 2009. Zizek, <http://www.youtube.com/watch?v=iGClv1xt0U>

6 Latour, Bruno. Politics of Nature. Harvard University Press. (2004, Cambridge) pp. 26
"Readers may protest that this is a paradox. If they do it is because they have the popularized version of deep ecology in mind: a movement with vague contours that claims to be reforming the politics of humans in the name of the "higher equilibria of nature"

7 Jarzombek, Mark. Eco-Pop. The Cornell Journal of Architecture 8: RE.

8 Giessen, David. Subnature – Architecture's other environments. Princeton Architectural Press (2009, New York)

9 Latour, Bruno. We have never been modern. Harvard University Press. Cambridge. 1993 pp. 32
"First guarantee: Even though we construct Nature, Nature is as if we did not construct it. Second guarantee: Even though we do not construct Society, Society is as if we did construct it"

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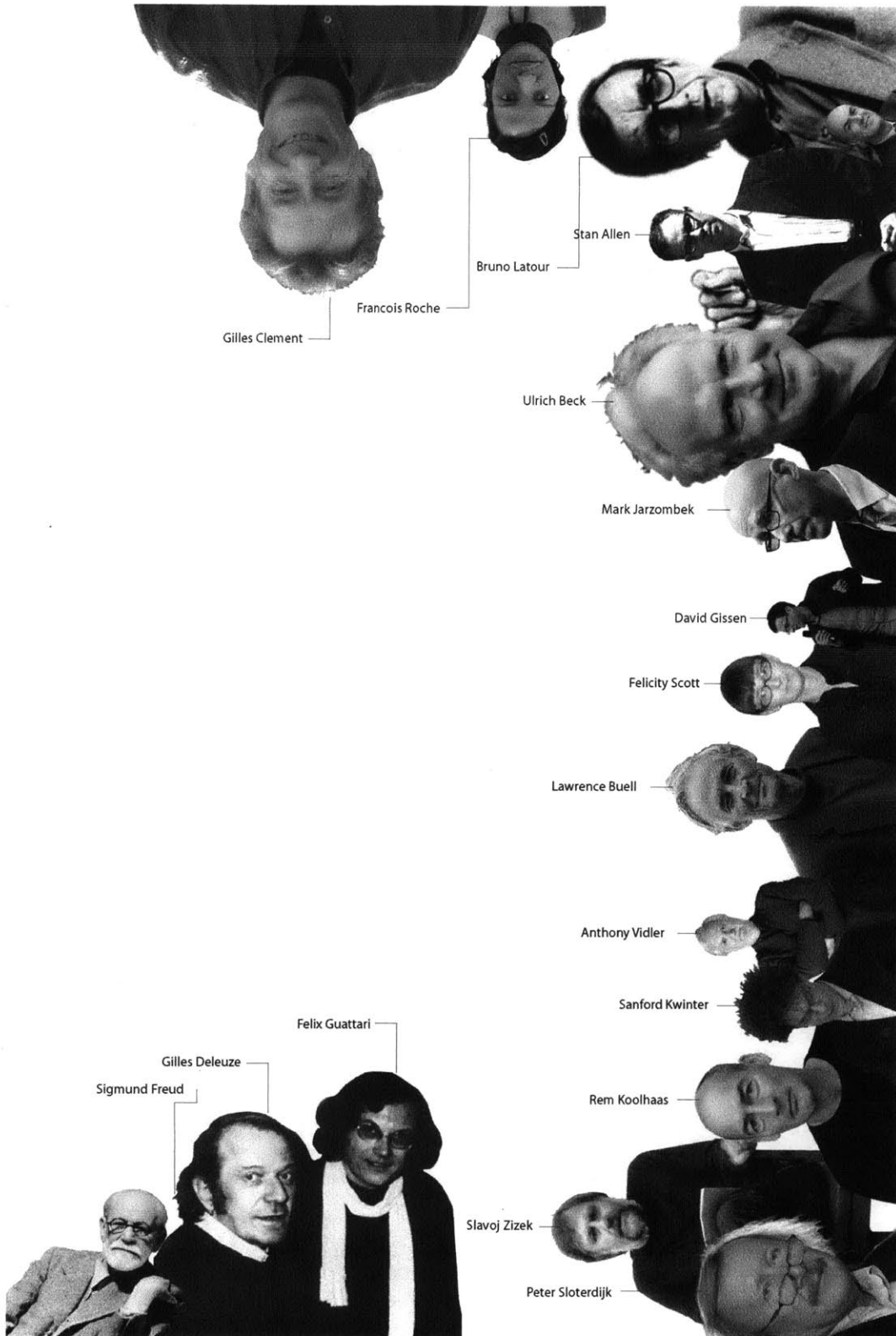
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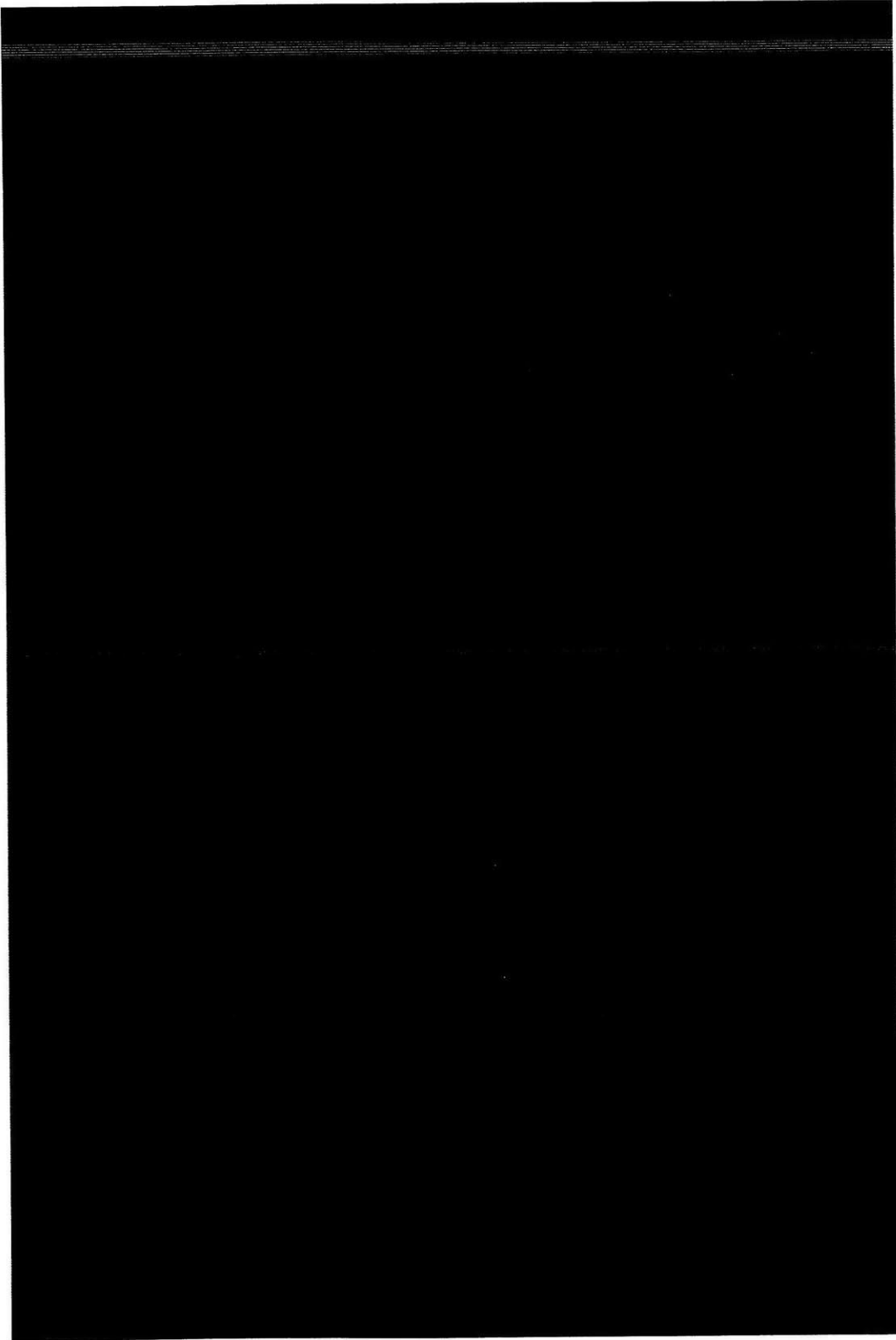
- 15 "Anthropocene". last modified 4 January 2012. <http://en.wikipedia.org/wiki/Anthropocene>
- 16 Allen, Stan "From the Biological to the Geological". *Landform Building: Architecture's New Terrain* (2011 Lars Mueller Publishers Baden, Switzerland. Princeton Architectural Press)
- 17 In "Living In The End Times". Verso (2010, London), Slavoj Zizek refers to the 2010 earthquakes in China and the role the construction of the Three Gorges dams played in it: "Something as elementary as an earthquake should thus also be included in the scope of phenomena influenced by human activity"
- 18 Buell, Lawrence. Toxic Discourse. 1998. *Critical Inquiry* 24(3): 639-665. pp 648.
Buell quotes Rachel Carson's "Silent Spring" from 1962
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- 28 Scott, Felicity D. *Architecture or Techno Utopia – Politics after Modernism*. The MIT Press. (2007, Cambridge, MA) pp. 210 / 211
- 29 Sloterdijk, Peter. *Terror from the Air*. Semiotext(e) (2009, Los Angeles) pp. 34
- 30 Zizek, Slavoj. *Living In The End Times*. Verso (2010, London) pp. 267
- 31 See "Return to Nature" - Symposium at the Harvard Graduate School of Design (GSD) in the Spring 2010
- 32 Vidler, Anthony. What Ever Happened to Ecology. *AD Ecoredux – Design remedies for an ailing Planet*. *Architectural Design* Vol. 80, No 6. November/December 2010 Wiley, London pp. 28
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or: Banham, Reyner. *Theory and Design in the First Machine Age*. The MIT Press. (1960, Cambridge, MA)
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Chapter 02
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02 b . Illustrated Research Essay

Chapter 01: The man made vs. natural

01 a . Ideology of ecology

Contemporary philosophy has long declared the “Death of Nature”³ - the conception of ‘Nature’ as a pristine, organic, un-touched and balanced entity (threatened only by human exploitation) should have been rendered altogether obsolete by now. While there seems to be consensus that most places on this planet are influenced and altered by human activity, yet, the ‘Myth of Nature’ (nature as pristine and balanced entity) continues to survive. A spectre is haunting the debate - unwaveringly persisting that ‘Nature’ is the pure, green, good and happy counterpart to our obscene, dangerous, gray and destructive society. Slavoj Zizek labels this thinking a “mystified, false and dangerous ideology of ecology”⁴: A quasi-religious obsession with a fictitious image of nature. Thinking about the current ideology of ecology, Zizek declares the death of nature: “There is no nature. Nature is not a balanced totality which we humans disturb; nature is a big series of unimaginable catastrophes...”⁵ Zizek is not alone with his assessment, for Bruno Latour states: “When the most frenetic of the ecologists cry out, quaking: “Nature is going to die,” they do not know how right they are. Thank God, nature is going to die. Yes, the great Pan is dead. After the death of God and the death of man, nature, too, had to give up the ghost.”⁶

A mystified reading of ecology and nature has ‘contaminated’ contemporary debate in architectural practice and academia. The disciplines’ mainstream reactions to climate change and global warming are based on a backward ideology of natural preservation. Falling into the spectre’s trap of natural preservation are ‘feel good basics’ such as ‘sustainable design’, environmental friendliness, LEED Platinum certificates, or elaborate ARUP energy concepts. The problem here lies in the initial assumption that ‘Nature’ (the mythical kind with a capital N) has to be preserved and protected in all its pristine greatness. Yet, the belief in a pristine and great ‘Nature’ constitutes a fallacy - such nature does not exist; it never has existed anywhere other than as a myth. There is a new common ground; we have to break away from past nature-ideology. In architectural discourse, ‘decontamination’ of past nature-ideologies is beginning to pick up speed. Architects and theoreticians are dismantling ‘Nature’ on all fronts: from Mark Jarzombek’s cultural critique “Eco Pop”⁷ to David Giessen’s obsession with “Subnatures”⁸, nature and the ideology of ecology are under close scrutiny.

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The Myth of Nature

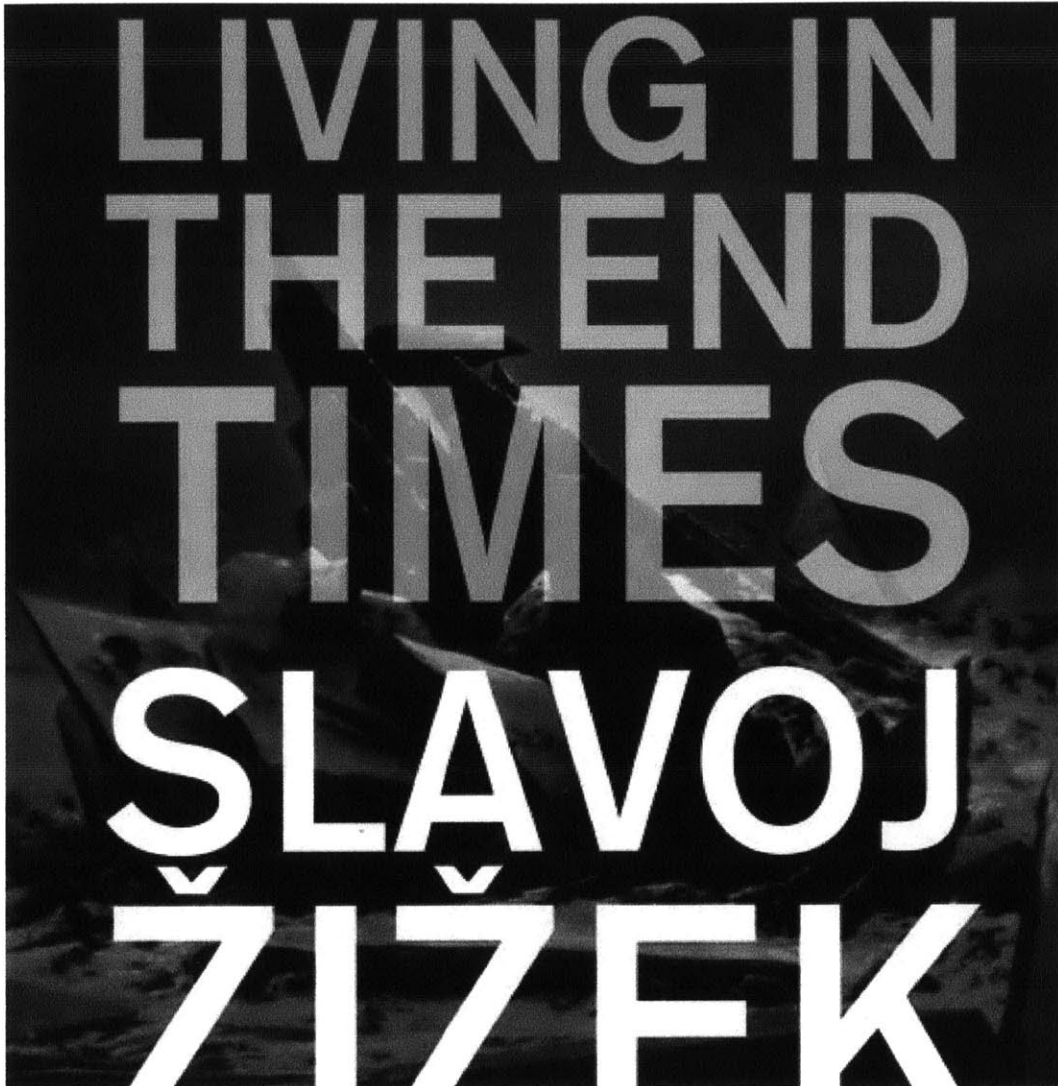




"The Myth"
James Cameron . Avatar

- 01 Nature is harmonious and balanced
- 02 Indigenous, vernacular, low-tech cultures understand nature better than our mainstream technological society
- 03 Nature is miraculous and friendly
- 04 Nature implies the existence of a higher order. This Supernatural order probably created Nature in its greatness

Avatar satisfies our longing and inner desire for a perfect nature. That's why it feels so good to watch it.



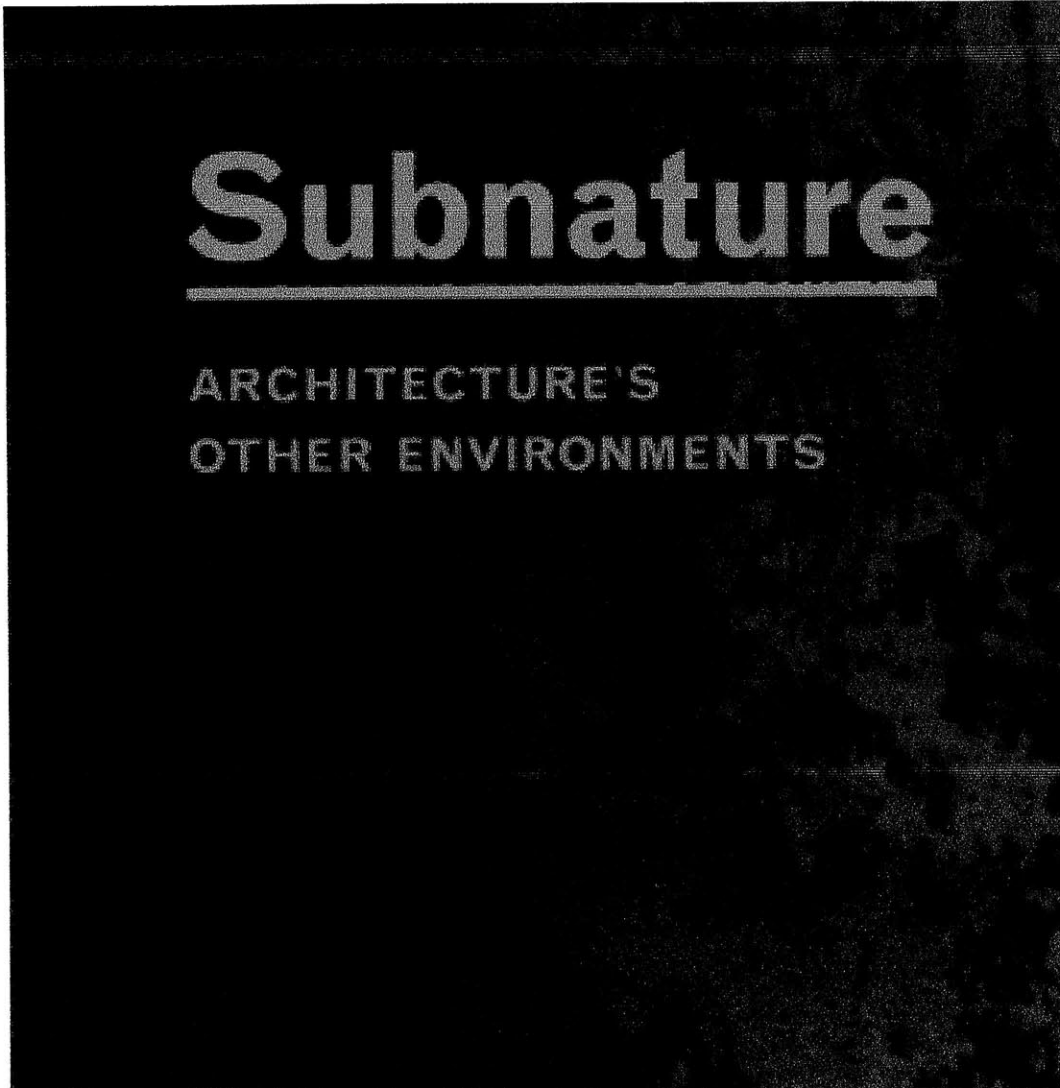
"The Marxist Perspective"
Slavoj Žizek . Living in the End Times

"There is no nature. Nature is not a balanced totality which we humans disturb; nature is a big series of unimaginable catastrophes..."

Žizek quotes Chakrabarty "The Climate of History":

"If the industrial way of life was what got us into this crisis, then the question is, Why think in terms of species, surely a category that belongs to a much longer history? Why could not the narrative of capitalism - and hence its critique - be sufficient as a framework for interrogating the history of climate change and understanding its consequences?"

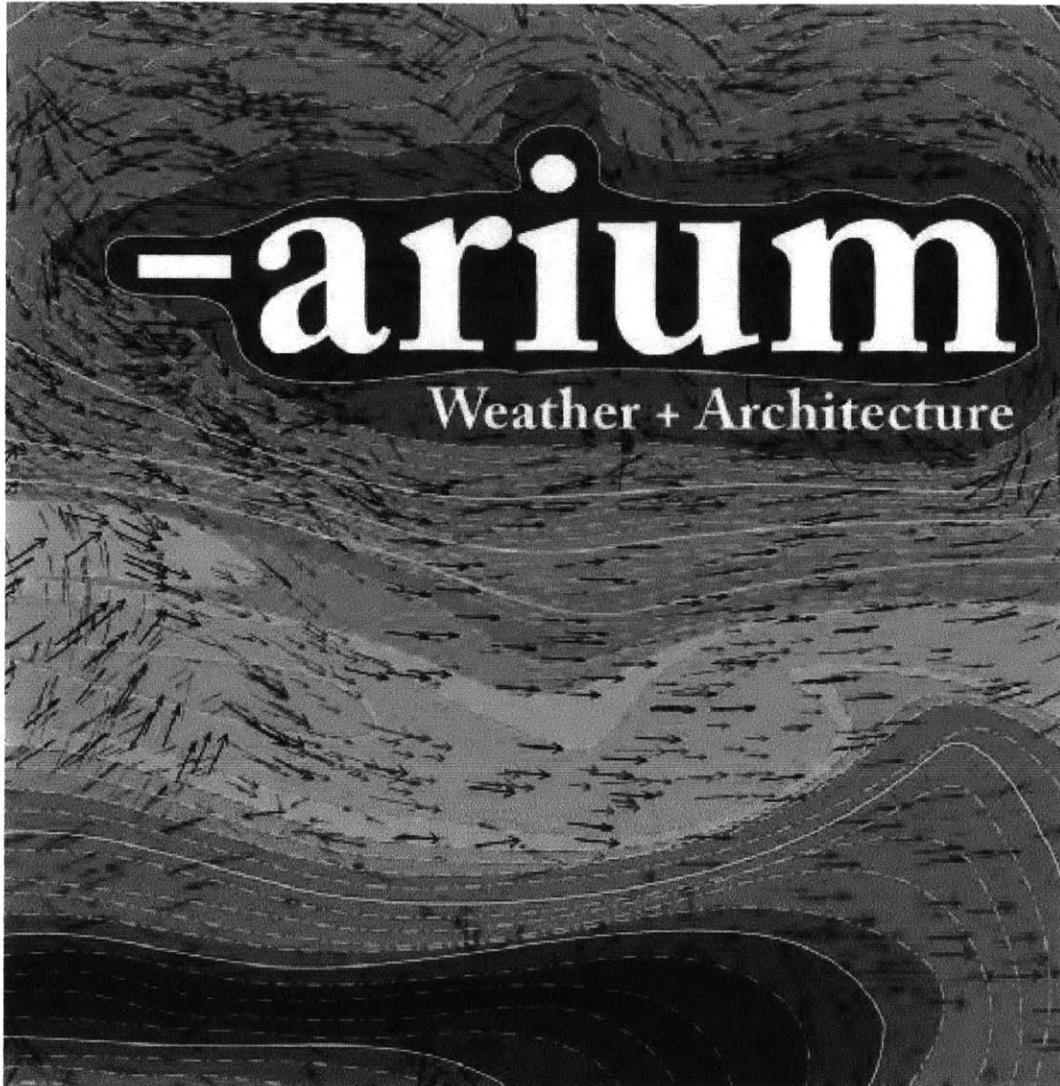
"The limitation of our freedom that becomes palatable with global warming is the paradoxical outcome of the very exponential growth of our freedom and power."



"The Other Environmental Perspective"
David Gissen - Subnature

"I argue that, forms of nature become subnatural when they are envisioned as threatening to inhabitants or to the material formations and ideas that constitute architecture. Subnatures are those forms of nature deemed primitive, filthy, fearsome or uncontrollable. We can contrast these subnatures to those seemingly central and desirable forms of nature - e.g. the sun, clouds, trees and wind."

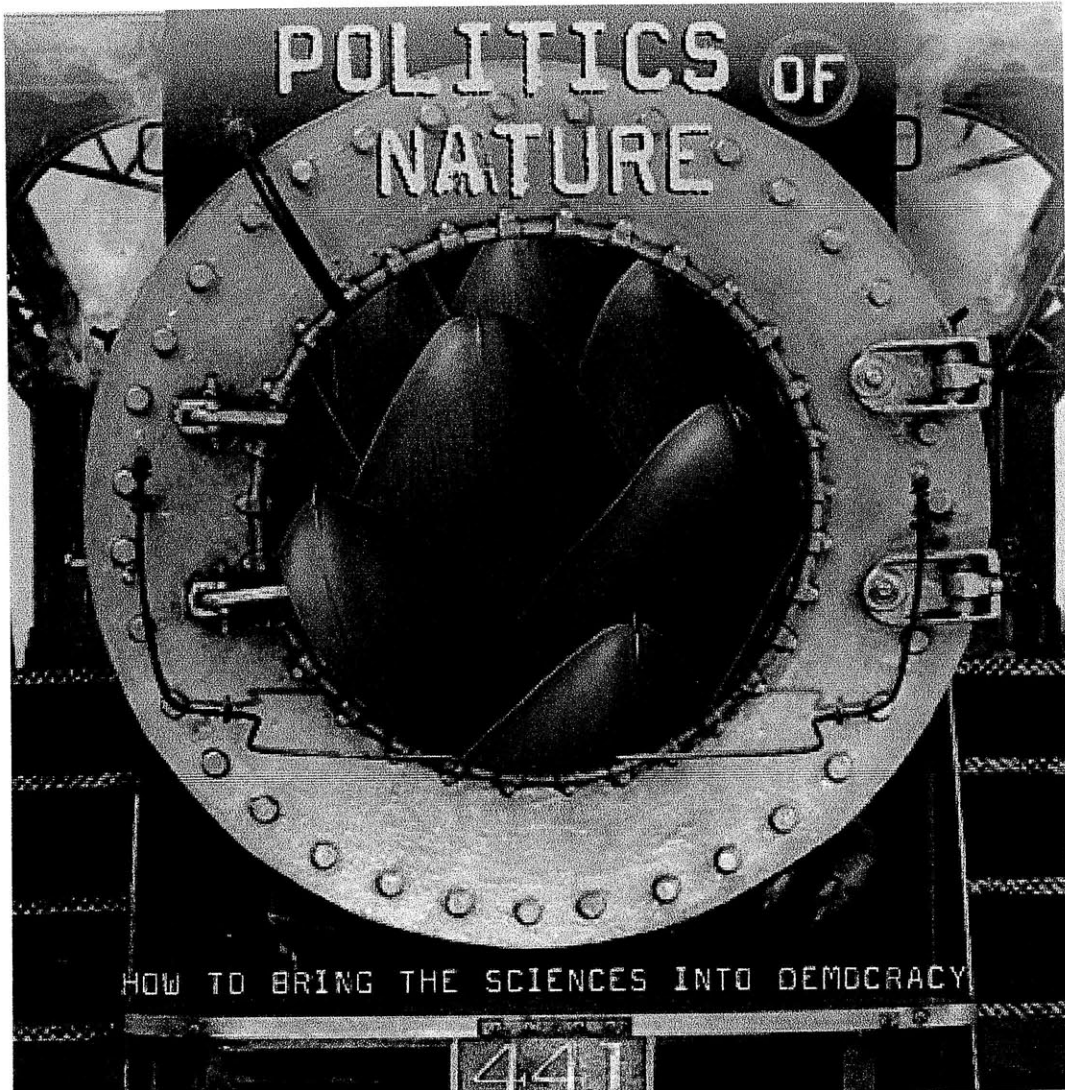
"If [...] the natural is the world in which human society is located, then the subnatural is the realm in which we can barely exist in the state that we currently conceive ourselves, both socially and biologically. It is that zone that is most fearsome, because it describes the limits in which contemporary life might be staged."



"The Environmental Perspective"
Juergen Mayer H. -arium . Weather and Architecture

"Weather is a natural phenomenon that impacts our health, economics, infrastructure, media, and of course, our architecture. Comprised of large and turbulent forces, weather could potentially be harnessed to be a productive and sustainable element in everyday life."

"Scientific prediction has increasingly replaced an intuitive reading of everyday weather in contemporary society. At the same time, weather remains one of the most difficult phenomena to forecast and define, constantly adapting to local and global atmospheric patterns. Attempts to tame this chaotic system have occurred through rigorous and meticulous prediction, which has created a prosperous commercial market - detaching one further from nature."



"The Democratic Perspective"
Bruno Latour . Politics of Science

"When the most frenetic of the ecologists cry out, quaking: "Nature is going to die," they do not know how right they are. Thank God, nature is going to die. Yes, the great Pan is dead. After the death of God and the death of man, nature, too, had to give up the ghost."

"Political ecology has nothing to do, or rather, finally no longer has anything to do with nature, still less with its conservation, protection, or defense."

"Under the pretext of protecting nature, the ecology movements have also retained the conception nature that makes their political struggle hopeless. Because "nature" is made, [...], precisely to eviscerate politics, one cannot claim to retain it even when tossing it into the public debate."

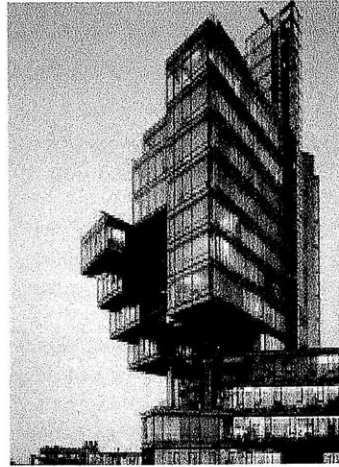
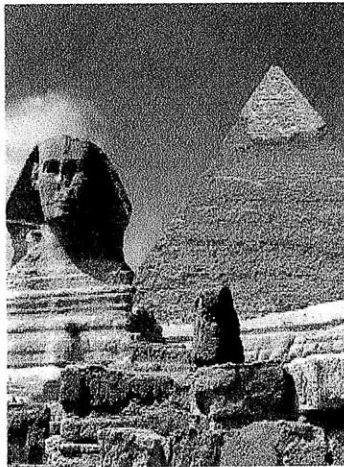
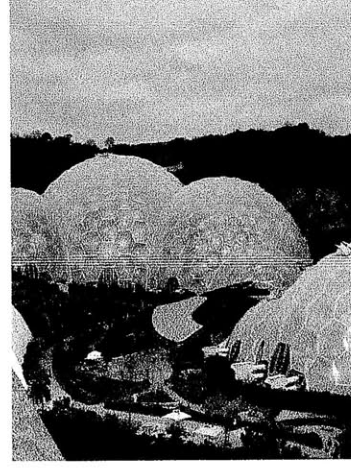
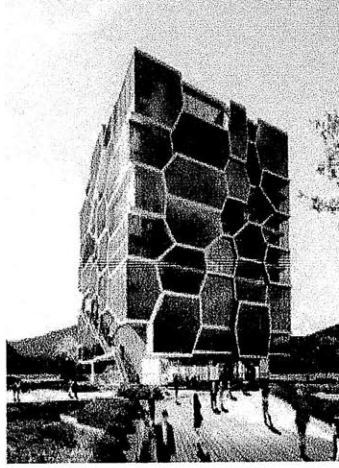
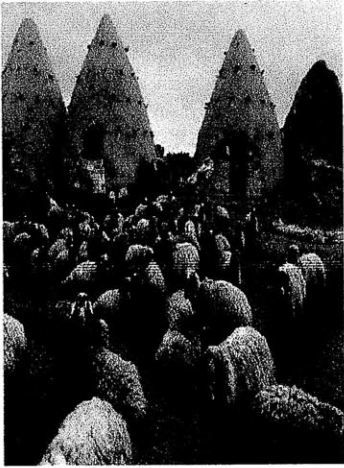
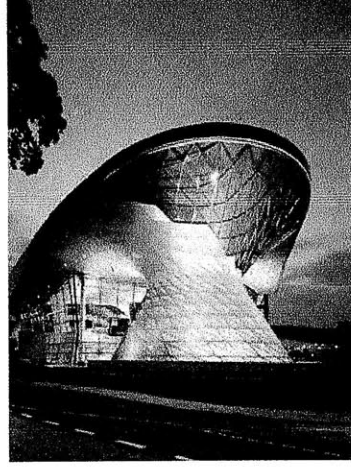
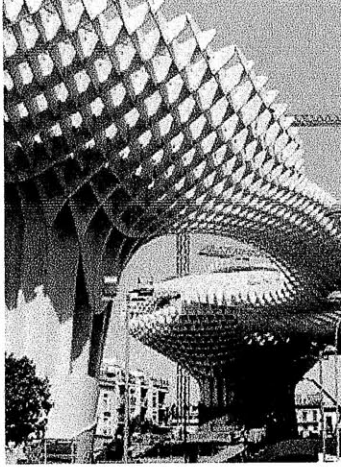
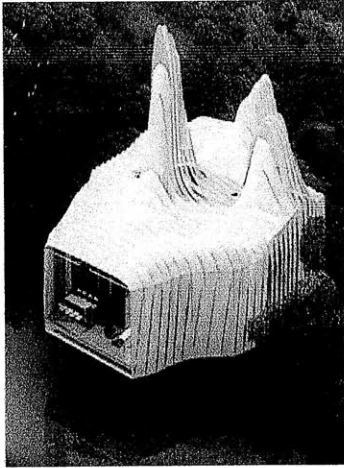


“The (Pop)Cultural Perspective”
Mark Jarzombek . Eco-Pop

“I do not lament the loss of culture and the death nature within the field of architecture, but state it as a given. Architecture must ultimately accept its fate as a disciple of uncertainty and to this end we must engage (or perhaps reengage) architecture as play of concepts—living or dead.”

“In the last 10 years, Sustainability and Form have dominated architectural discourse, trapping the discipline between utopian play-acting—promising what it cannot deliver—and computerized “gaming” of design extremism. Culture, if one can use that word, has been more or less abandoned, taken over by the preservationists and vernacularists, not known for their theoretical elasticity and design creativity. The result is a dead zone at the center of architectural discourse.”

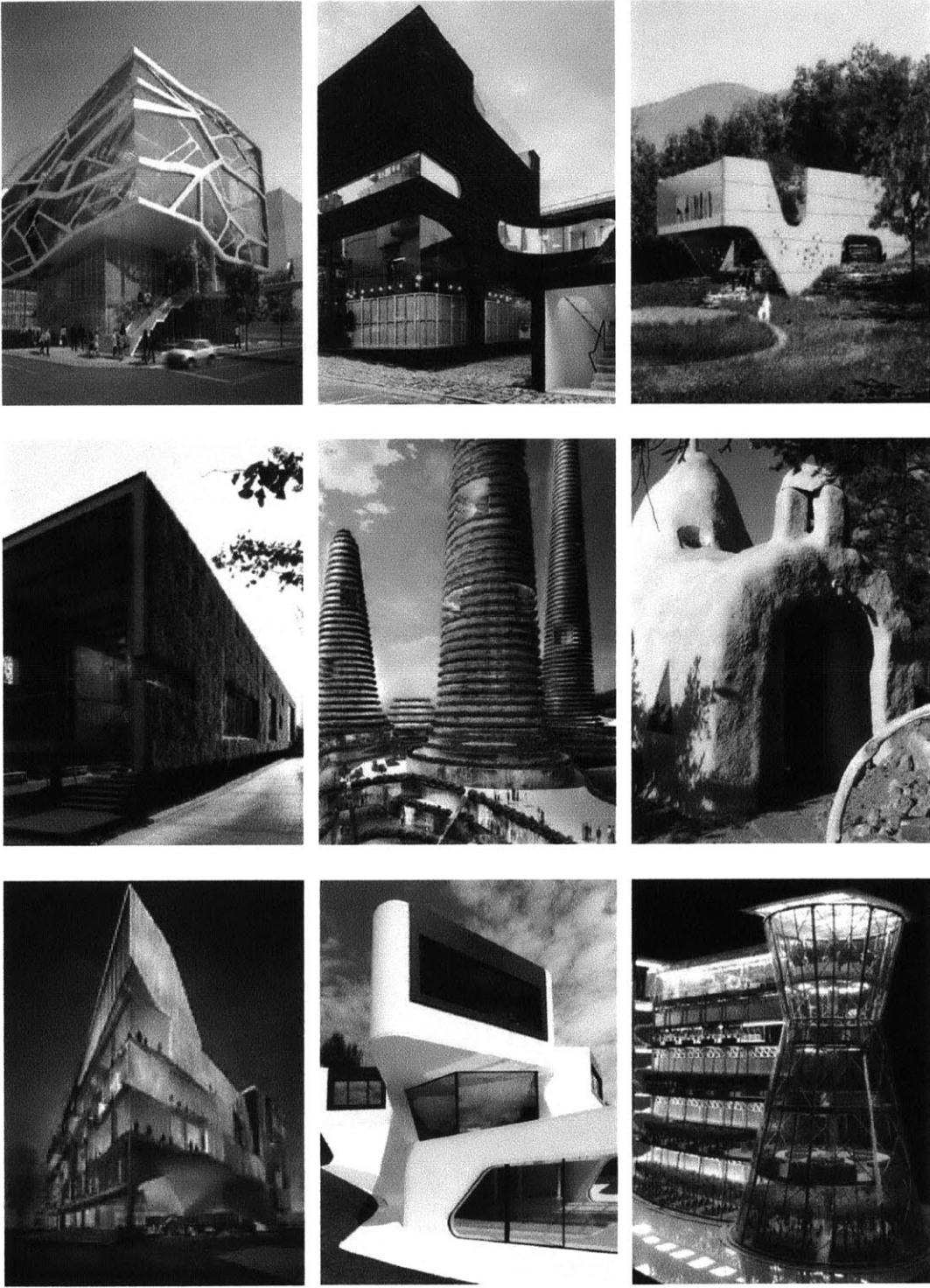
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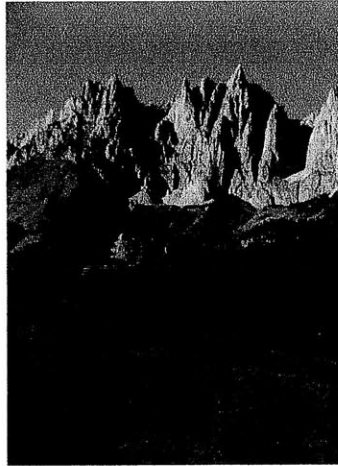
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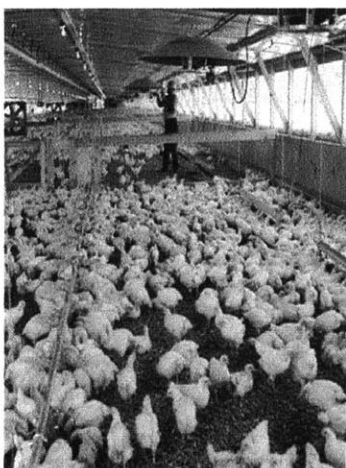
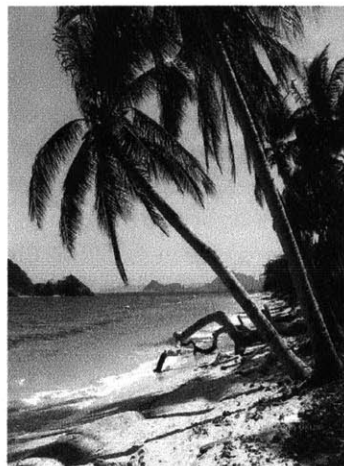
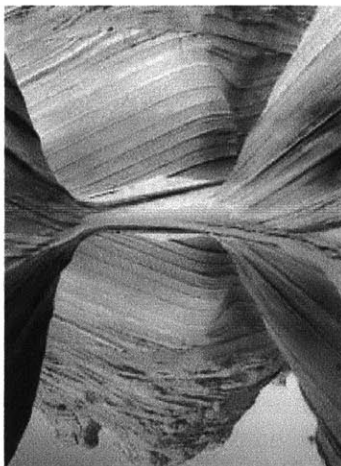
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"Natural"

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Chapter 01: The man made vs. natural
01 b . Hybrid natures . Hybrid territories

In "We have never been modern", Bruno Latour places the split between nature and society at the core of the "modern constitution"⁹ According to Latour, the base for all Moderns is an absolute distinction between 'Nature' (even though we construct nature it is not our construction) and 'Society' (even though we do not construct society it is our construction). Living comfortably with this divide was possible until suddenly, "[...] we find ourselves invaded by frozen embryos, expert systems, digital machines, sensor equipped robots, hybrid corn, data banks, psychotropic drugs, whales outfitted with radar sounding devices, gene synthesizers, audience analyzers, and so on, when our daily newspapers display all these monsters on page after page, and when none of these chimera can be properly on the object side or on the subject side, or even in between, something has to be done."¹⁰

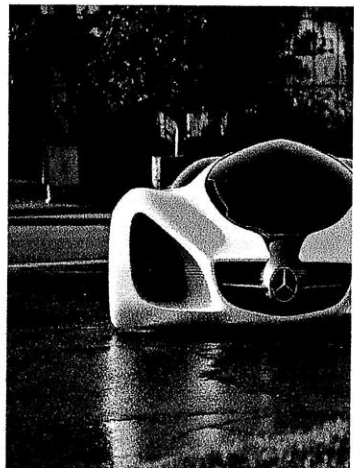
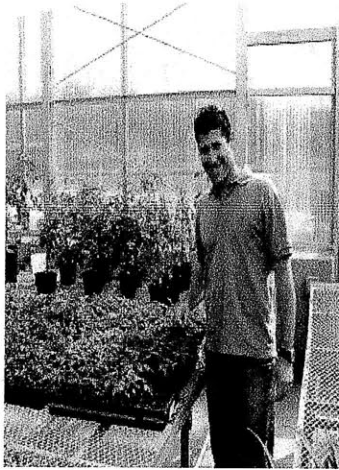
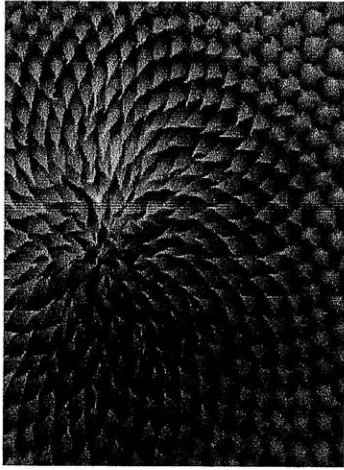
Latour suggest the development of a new constitution in which "Nature and Society are not two distinct poles, but one and the same production of successive states of societies-natures, of collectives."¹¹ This idea takes into account that half of politics is in fact constructed in science and technology while the other half of nature is constructed in societies. In the end, nature is not only dead, it is replaced by a collective society-nature, a hybrid, in which everything 'natural' comes equipped with the matching 'cultural'- and vice versa. (The bird comes equipped with its ornithologist, the weather with its meteorologist, the melting pole ice cap with its Nobel Prize winning politician, etc.). In architecture, nature-culture hybrids like Gage Clemenceau's "Bio-prosthetics"¹², Liam Young's "Specimens of an unnatural History"¹³, or R&Sie(n)'s "Mosquito Bottleneck"¹⁴ have revived debate about collectives. It seems that in contemporary practice, the interest in hybrids parallels the rise and advancement of digital technology, making it easier to visually simulate natural complexity. The supposedly new 'avant-garde' has yet to prove that it is able to move beyond a semiotic, 'gimmicky' reading of hybrids. To ungimmick hybrids might require a stronger shift in scale towards hybrid territories as well as a more expansive elaboration of hybrid cultural effects.

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Hybrid Natures



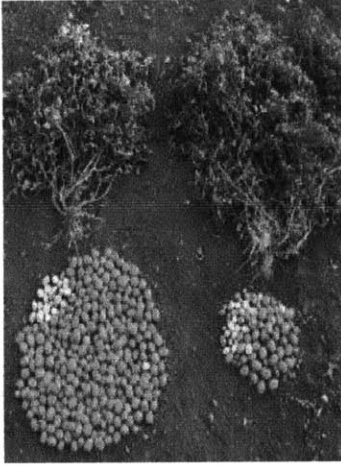
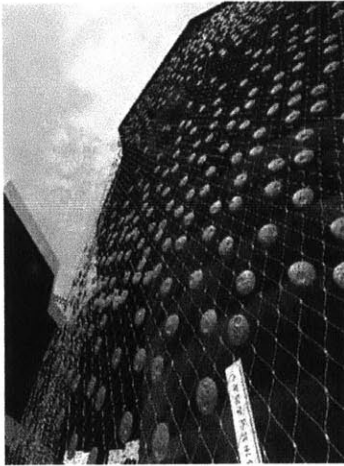
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Chapter 01: The man made vs. natural

01 c . Anthropocene territories

The 'death of nature' and the establishment of a 'society-nature' hybrids are in concert with a broader paradigm shift in the discipline of geology. Since 2008, ecologist Eugene Stoermer and Nobel Prize-winning atmospheric chemist Paul Crutzen have advocated for instituting a new geological cycle: the current Holocene is presumed to be replaced by the Anthropocene (anthropo- meaning 'human' and -cene meaning 'new')¹⁵ to reflect that humans have become a measurable geological factor in Earth's history. Today, climate change, loss of biodiversity, sea level rise, intensive agriculture and changes in the atmosphere are all registering in Earth's geology. Yet, modification of the environment by humans is not a novel or uniquely modern phenomenon. Some geologists argue that the Industrial Revolution marks the beginning of the Anthropocene, others advocate for the Agricultural Revolution which started about 8000 years ago. Either way, the Anthropocene has already begun, although it has been manifested only recently.

If one considers architecture to be "situated between the biological and the geological – slower than living beings but faster than the underlying geology" (Stan Allen)¹⁶, the conceptual implications of an anthropocene age for the discipline of architecture are substantial. The last citadel of 'Nature' has fallen as humans are now in control of the ground; transformation towards a hybrid state of anthropocene logics has begun.¹⁷ Novel definitions of formerly familiar holocene categories such as 'biological', 'natural', and 'geological' will require an architectural paradigm shift to accommodate hybrids or collectives. In the Anthropocene, the relationship between the 'man-made' and the 'natural' will be questioned and challenged radically: in the end, anthropocene territories will require anthropocene architectures.

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The Anthropocene



Chapter 02: Contaminated environments
02 a . Toxic territories . 'Matter out of place'?

Toxicity is causing a paradigm shift away from 'mythical natures' towards anthropocene territories. Notably since the Industrial Revolution, toxicity has become a 'natural' part of our environment; to the point that "for the first time in the history of the world, every human being is now subjected to contact with dangerous chemicals, from the moment of conception until death."¹⁸ The 'myth of nature' has long been disenchanting by pollution. This process of disenchantment allows for a redefinition of 'society-nature collectives': Bridging the social and the natural-toxic, Ulrich Beck has recognized the broader social implication of pollution when he made the claim that "poverty is hierarchic,[but] smog is democratic."¹⁹ In that sense, pollution can be understood as the new unifier of our "Risk Society". Dust covers queens, factory workers, prime ministers, bums, presidents, prostitutes, movie stars, and dictators. Toxic territories are potentially democratic territories.

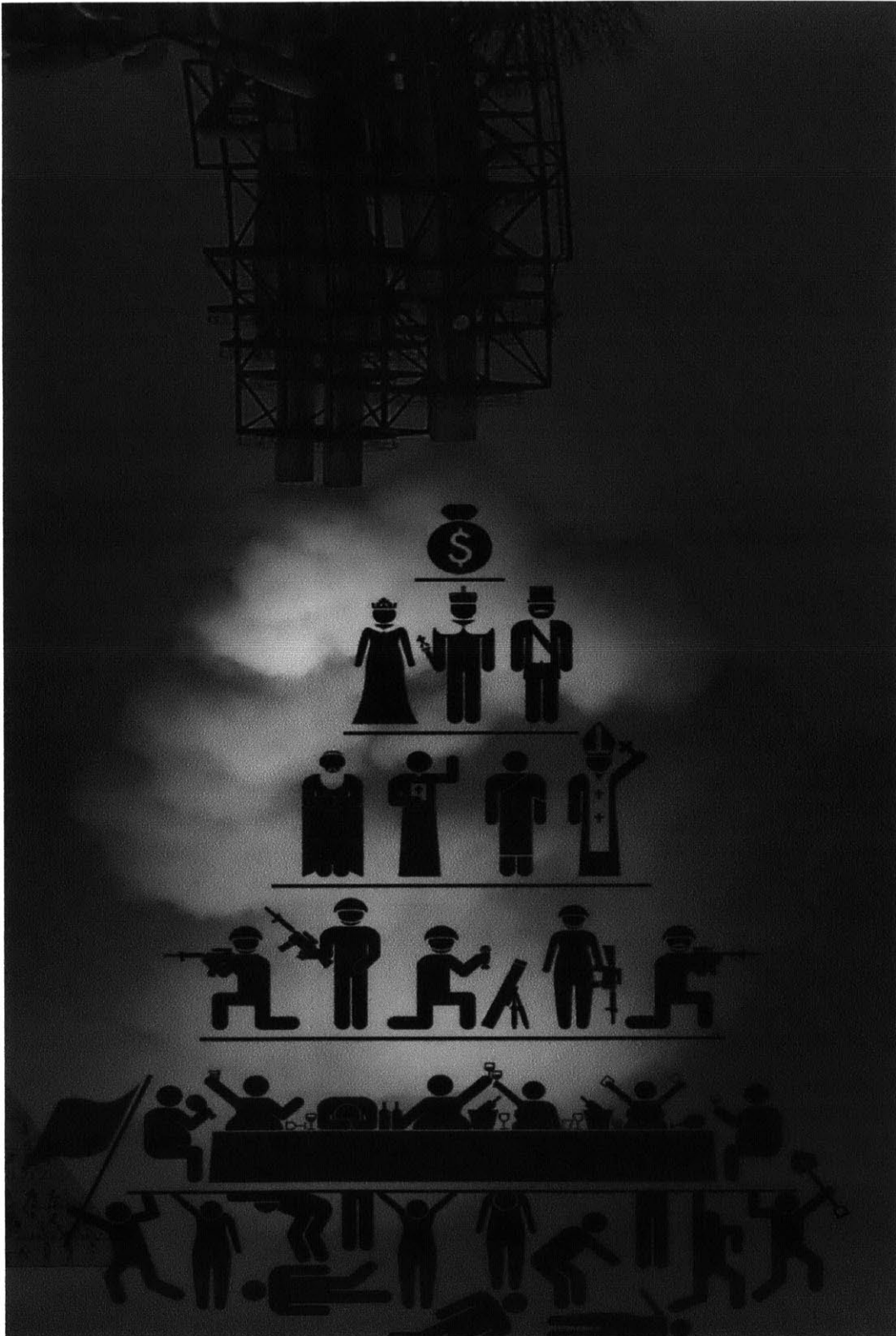
Yet, historically, pollution tended to work the other way: Sanford Kwinter states that "ideas of contamination, [...] are by all accounts endemic to human societies since their earliest beginnings"²⁰ Here, Kwinter refers to the idea of social impurity and symbolic realities in the context of dirtiness and contamination. According to Kwinter, conceptually, contamination serves to "maintain moral and social order". Hence, in the social context, contamination constitutes the foundation of an anti-democratic, hierarchic caste society. Yet, this seemingly 'social lowlife' -the 'dirty' and 'contaminated' - manages to challenge existing law and order: "Dirt is a disorder that threatens an existing or even emerging pattern, a formlessness that threatens form."²¹ In this sense, dirt is a potential catalyst for rebellion. It is "matter out of place"²² which de-territorializes existing orders and organizations. This is true for both, architectural organizations as well as socio-political orders. Current environmental unrest in China, for example, is seen as the greatest threat for the Chinese political system by its government: Hu Jintao knows that "without stability, nothing can be accomplished."²³ Dirt endangers the status quo. In architecture, dirt questions the modern paradigm for a clear separation between man-made (architectural) and natural (landscape) systems. Framing the landscape in a Corbusian manner and declaring it a hybrid won't suffice anymore as the distinction between nature and society continues to blur. In the Anthropocene, architecture and landscape merge - dirt is the cement which holds the two together.

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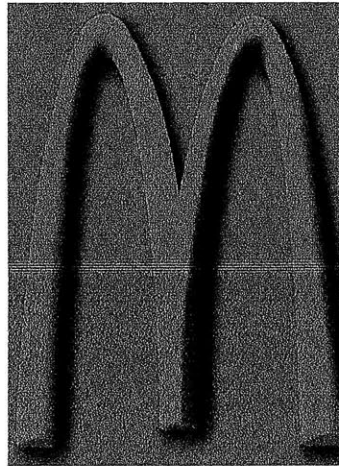
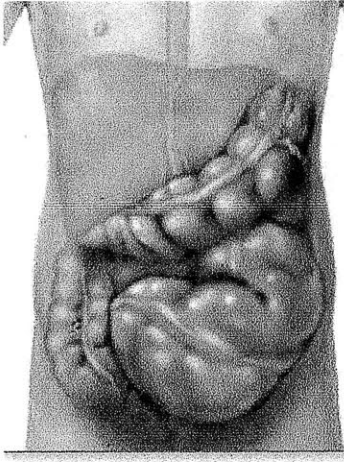
Ubiquitous Toxicity







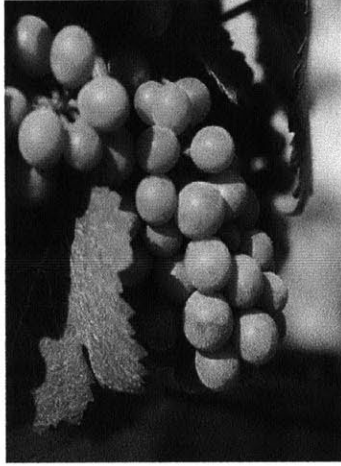
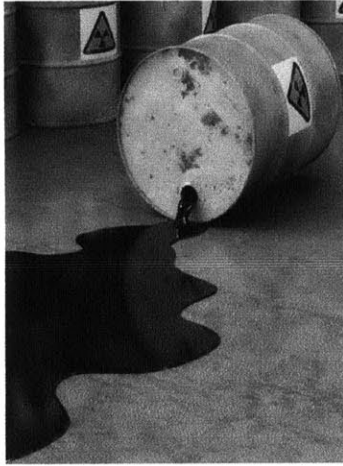
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Chapter 02: Contaminated environments

02 b . Fear of contamination and the aesthetics of anxiety

"Dirt of any kind seems to us incompatible with civilization; we extend our demands for cleanness to the human body also, and are amazed to hear what an objectionable odour emanated from the person of the Roi Soleil"²⁴ In the most extreme case, the rejection of dirtiness can lead to a complex fear of contamination. Howard Hughes, for example, suffering from obsessive-compulsive-disorder (OCD) was unable to leave his house, concealing himself in a germ-free environment avoiding to touch anything or anyone.²⁵ The social and physical fear of contamination is a strong subconscious influence in how we approach toxic territories. In "Warped Space", Anthony Vidler describes fear, anxiety, estrangement and their psychological counterparts, anxiety neuroses and phobias as a fundamental part of the "aesthetics of space throughout the modern period".²⁶

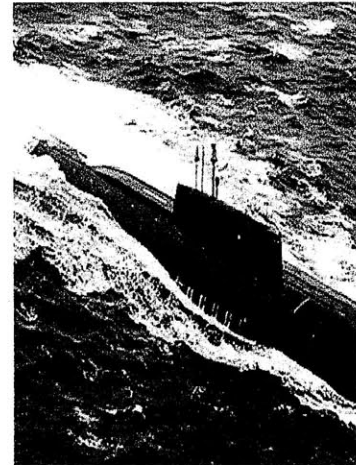
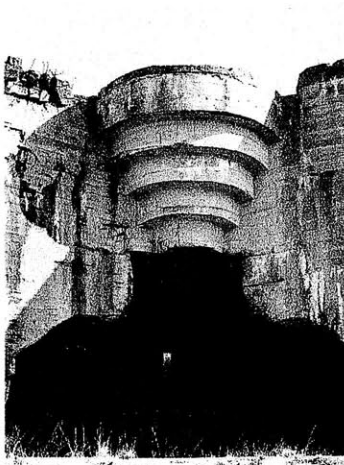
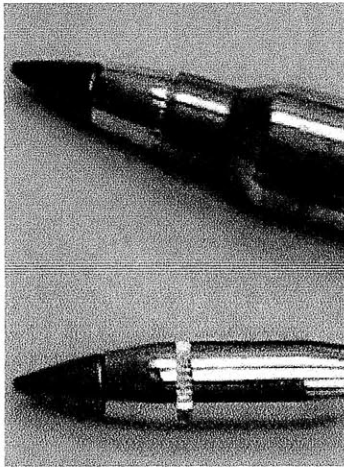
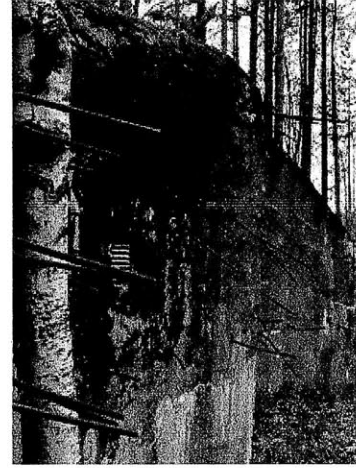
Modern aesthetics of anxiety and contamination seem reminiscent of military-industrial-dystopian projects. (see: Paul Virilio's book "Bunker Archeology"²⁷ or Ant Farm's installation "Clean Air Pod"²⁸). Contamination and related notions of anxiety are equipped with their own, extreme form of aesthetics. Empowered by the advancement of digital modeling techniques, the work of contemporary practices such as R&Sie(n) or Mitchell Joachim (Terraform One) has embraced a dystopian aesthetic of contamination in form of strange, biomorphic, spiky buildings or landscapes reminiscent of tanks, war machines and bunker architecture. The question needs to be raised if contaminated territories really necessitate and justify those aesthetics? It seems that a catchy aesthetic automatism is being proposed in this context rather than admitting that the turn towards the military-industrial-dystopian marks a conscious, (critique-able) design decision. A rethinking of military-industrial-dystopian aesthetic in the context of building in toxic territories seems imperative.

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Maximum Uncanny - Francois R. meets Daniel L.



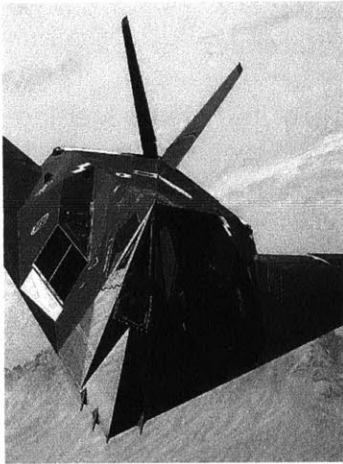
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Chapter 02: Contaminated environments
02 c . Architectural two-folds . Threshold dichotomies

In "Terror from the Air", Peter Sloterdijk discusses "demothization" techniques (getting rid of moths through the use of gas) at the beginning of the 20th century and a parallel emergence of an environmental awareness by questioning the release of toxic substances into the atmosphere: "After [...] the development of environmental awareness, zones emerged in which the relationship between the surrounding air and the contaminated air zone became inverted. In other words, artificially created – or we might now say: the air conditioned - zones emerged which provided privileged air conditions relative to the general surroundings [...]"²⁹ Today, architecture is facing a 'contamination paradox' evolving around the question of 'conditioned environments'. In the not too distant past, buildings only needed to ensure that the interior does not get contaminated by surrounding environmental factors such as air, wind, cold, and sun. Today, environmental awareness has created a paradigm shift, putting emphasis on buildings which attempt to minimize contamination of the environment through the use of environmentally friendly materials or building technology. A building now needs to do both, protect from exterior contamination and protect the exterior from contamination. Paradoxically, 'demothization' is an architectural two-fold: hence, we eradicate 'moth no.1' in the filter of our building's air intake system while making sure to protect it's friend, 'moth no.2' by buying 2x4's from insect-friendly forestry. This logic applies to many processes particularly regarding the architectural envelope. A Passive House, for example, is a hermetically sealed bunker whose only connection to the exterior is entailed by its mission not to have any impact on its surroundings whatsoever.

The contamination paradox around the architectural envelope has further reinforced a historic dichotomy between interior and exterior environments. Only few projects like, for example, FOA's Yokohama Port Terminal manage to successfully establish a more ambiguous reading between interior and exterior spaces, revealing possible spatial and socio-political opportunities in what Slavoj Žižek calls a "Deleuzian poetry of fluid deterritorialization"³⁰. Acknowledging anthropocene logics of contamination, past dichotomies such as the binary between the interior and the exterior need to be questioned. In this context, natural preservation is a false premise and counterproductive even to its own goals (and its naïve interpretation of a balanced relationship between man and nature) for who owns a Passive House bunker has managed to build and live in a diagram of Latour's modern constitution: chapeau! It truly goes without saying that the past architectural two-fold constitutes a dead-end. Time to move away from binaries...

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Anxious House



Chapter 03: Redefinition impossible?

03 a . Review of past architectural techno-environments

The “Return to nature”³¹ in academia and practice predicates a cyclical phenomenon: In “What ever happened to Ecology”, Anthony Vidler describes that architectural ideas relating to environment and ecology had several revivals during the 20th century but that “these successive waves of interest have episodically been lost or forgotten by the mainstream of the architectural profession.”³² Current discourse is strongly engaged in reviving the work of Buckminster Fuller, Reyner Banham, John McHale, the Metabolists, the Independent Group, the Droppers, and other key figures of the 1950s and 1960s.³³ The importance of this episode for today’s debate lies in its diverse dispute about the role which technology plays in shaping our environment.

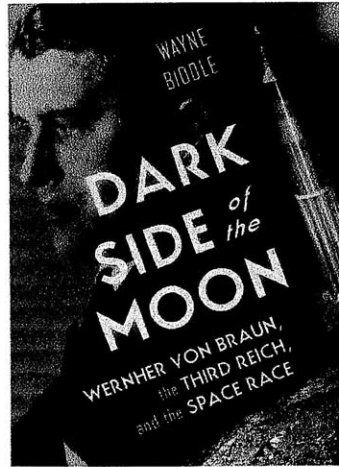
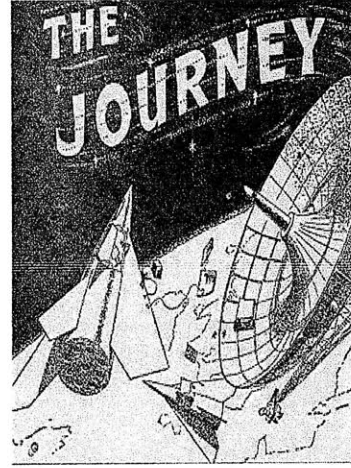
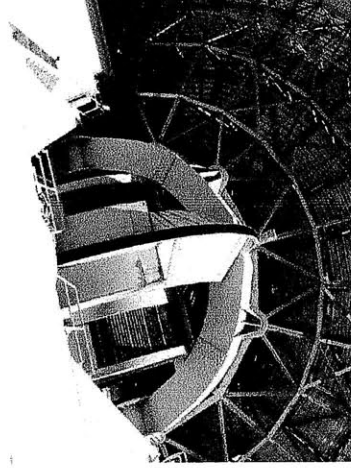
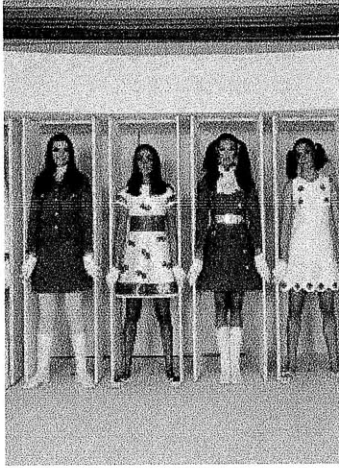
“In order to approach the question ‘Whatever happened to ecology?’, we must survey the battlegrounds of the 1950s and 1960s and the resulting lines drawn between programmers, techno-futurists and formalists”³⁴ With today’s means of technology, the battle has reached a new level of complexity. Looking back reveals flaws in current thinking. A sense of urgency towards global environmental problems is not a novel condition. Many seemingly contemporary avant-garde ideas are, in fact, merely recycled ‘techno utopian’ concepts.

In this context it is interesting to add Bruno Latour’s claim that the realization of techno utopias such as the space program caused “the arrow of time” to change its shape and direction back towards the concerns of our planet: “It is hard to imagine that in such a short span of life, the “arrow of time” too has so thoroughly changed its shape and direction. It is not an arrow anymore, targeting some well-accepted goal. It is rather like a plate of spaghetti, zigzagging around without leading in one direction, to one climax.”³⁵ It is the first image of the whole Earth captured by the crew of the Apollo 8 mission which led the generation around Buckminster Fuller to focus on ‘Spaceship Earth’. Today, the complexity and fragility of our planet’s ecology are once more at the center of attention – for different reasons than in the 60’s, but nevertheless.



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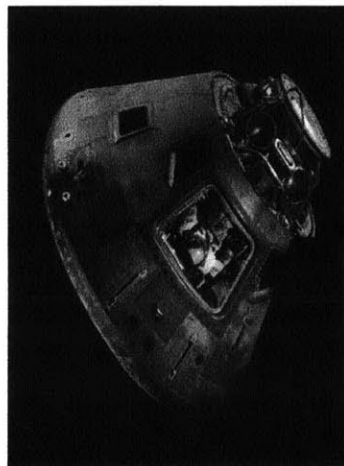
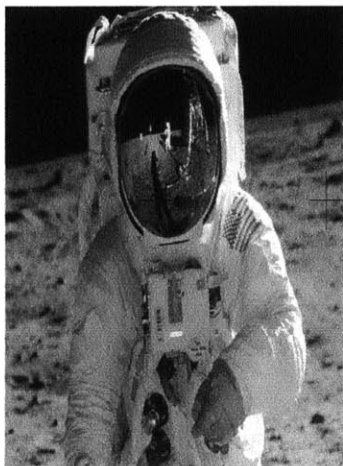
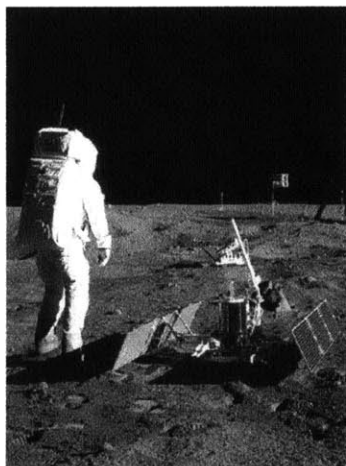
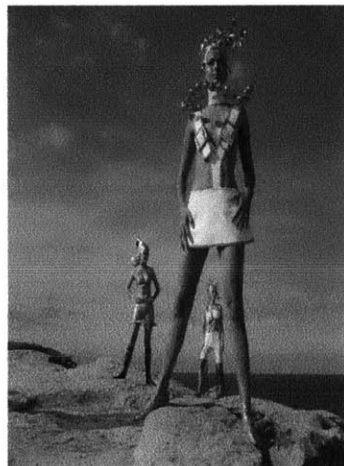
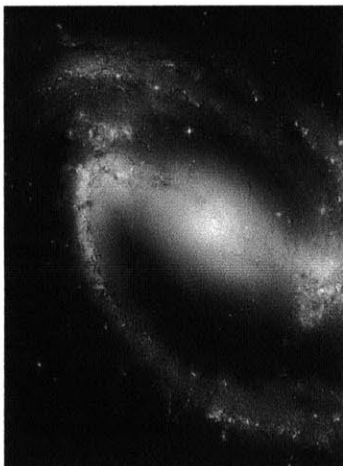
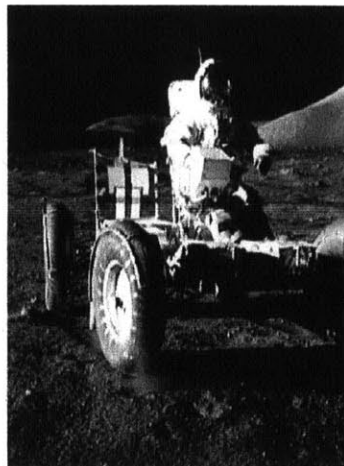
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Chapter 03: Redefinition impossible?

03 b . Politics of neo-natures?

The current debate about 'Nature' questions former concepts of ecology and environment. New nature paradigms are emerging: "The manifesto on the third landscape was based on the notion that the undeveloped plot or leftover fragment of the *jardin planétaire* is the refuge of earth's biodiversity, and thus our biological future. Such spaces are found everywhere in the world. Every rural or urban development venture, however technically accomplished and in whatever spirit of land use, generates some wasted space that awaits a future."³⁶ There exist many similar concepts to Gilles Clement's "third landscape". (see: David Giessen's "Subnature", Françoise Roche's "Corrupted Biotopes"³⁷, or Antoine Picon's "Anxious Landscapes"³⁸). Generally, all these concepts share anthropocene ideas about new society-nature relationships. In the case of Clement, the turn towards forgotten and wasted landscapes is also a criticism of the society which initially produced the third landscape. It seems that the third landscape constitutes both, a paradigm shift in how a society views nature, and evaluate its own predicaments. In the end, embracing neo-environments is an act of politics.

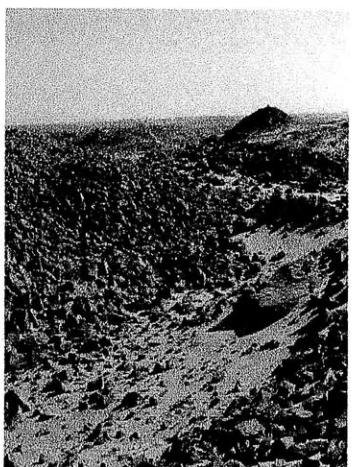
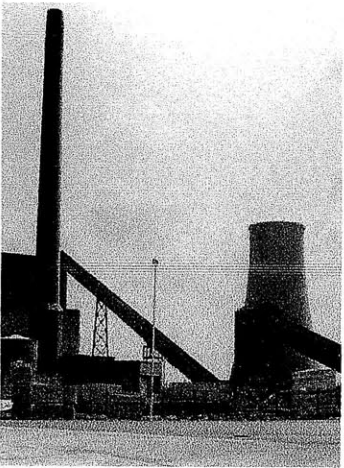
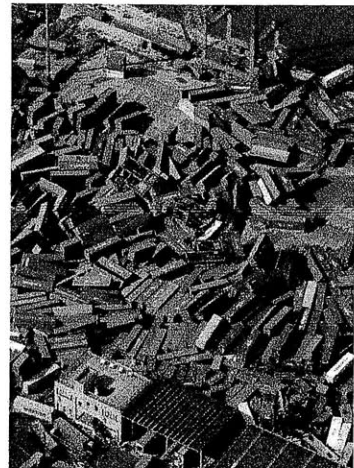
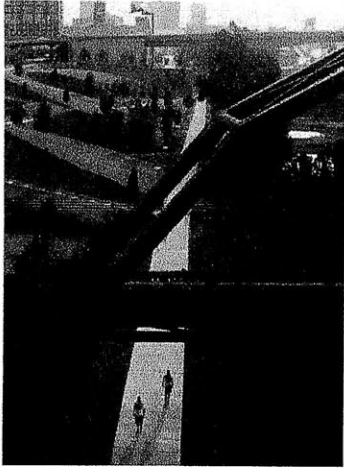
Dirt, dust, debris, smoke and weeds are the supposedly new anti-generic. They are architecture's 'punks': un-integrated, kind of cool, a bit dangerous, but fascinating outsiders. Natural leftovers (aka. nature punks) come equipped with their own politics of de-territorialization.³⁹ They oppose existing orders while occupying new territories. Away from mainstream 'Nature' those leftovers establish new relations between society, politics, nature and environment. They are able to critique the conditions which have created them by embracing things which are not part of the polished mainstream of popular culture. Architecturally speaking, this 'Nature Junk' yields the potential to confront generic "Junk Space"⁴⁰ with alternate politics by embracing the "heterotopic"⁴¹ qualities of natural leftovers and 'third landscapes'. Will nature junk, dirt and pollution, - all children of capitalism and consumerism - end up sabotaging and undermining the hard work of their own parents? Are such the politics of the Anthropocene?

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Nature Junk



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Chapter 03: Redefinition impossible?

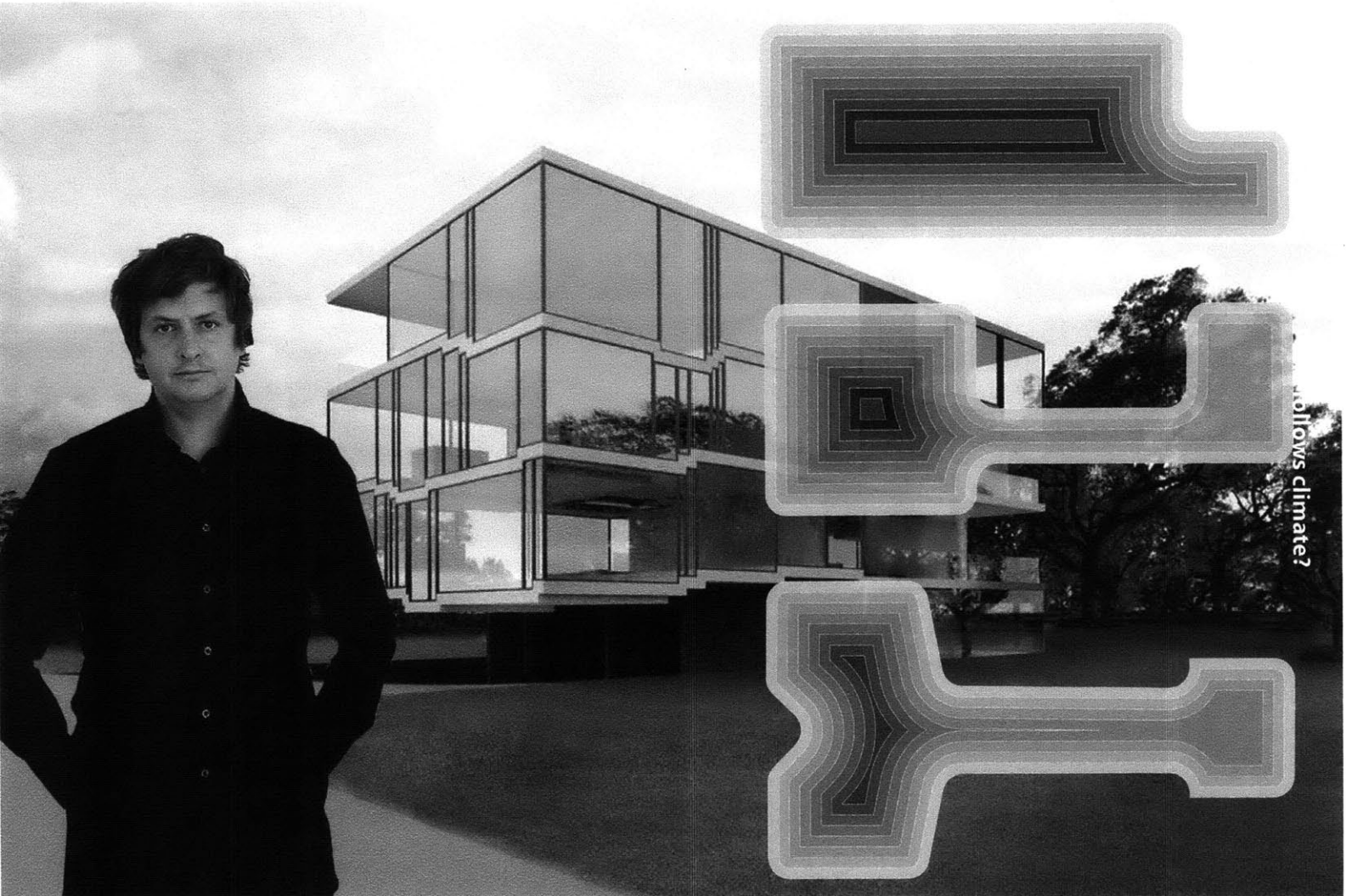
03 c . Temporality in times of compromise-ariums?

The discussion about nature and environment has led to a 'meteorology-, climate-, and weather 'hype' in current discourse. Supposedly revolutionary new climatic architecture, "free of formal and functional predeterminations"⁴², emerges from analyzing weather and air flows. We are living in ecological times; today, "form and function follow climate"⁴³

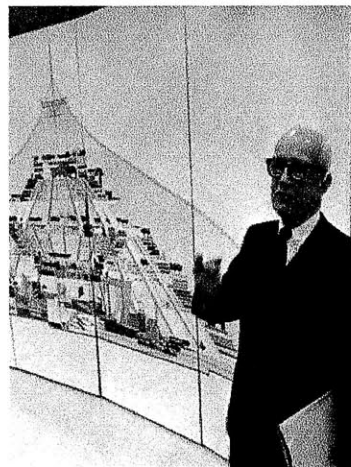
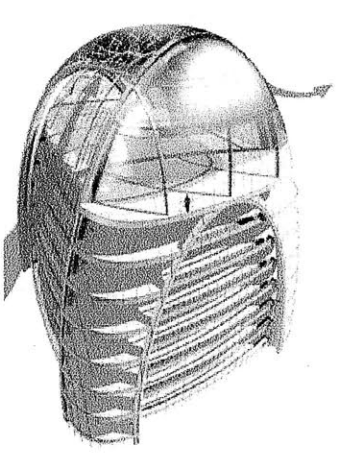
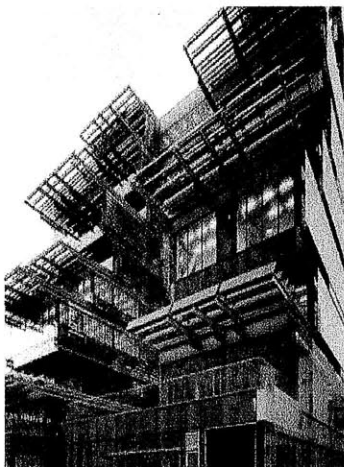
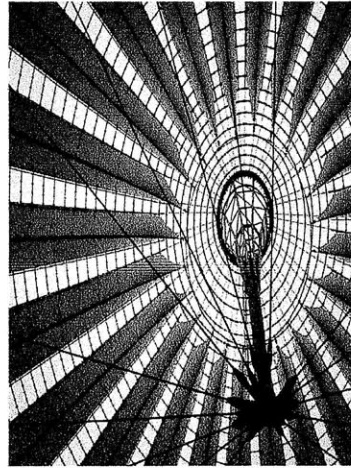
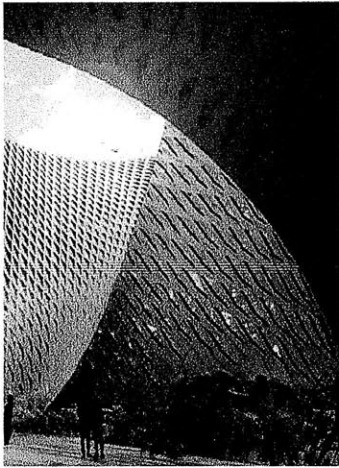
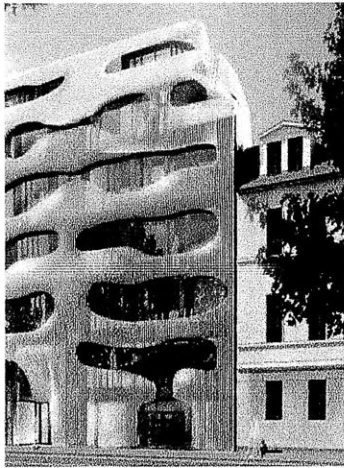
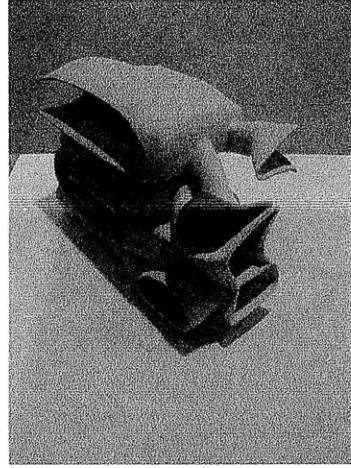
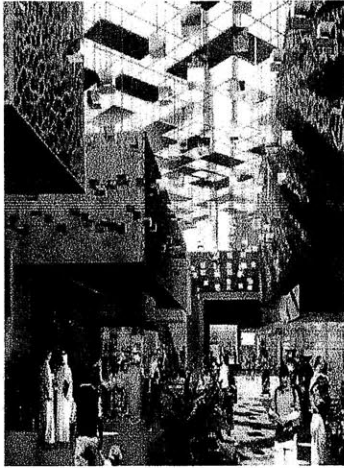
Climate architecture has many followers: Investigating -ariums⁴⁴, climates and weathers for the wrong reasons (with a mindset of scientific accuracy) has led to an inflationary understanding of architectural temporality. Complex concepts are being dumbed down into architectures of 'radiation', 'evaporation' or 'conduction'⁴⁵. In "Terror from the Air", Peter Sloterdijk claims that we would need a new kind of physics to adequately analyze processes which are as complex as the interplay between "the atmosphere (gaseous envelope), the hydrosphere (water world), the biosphere (plant and animal worlds), the cryosphere (the ice regio) [and] the pedosphere (solid land), which, under the influence of the sun's radiation, comprise extremely complex patterns of energy exchange."⁴⁶ Taking this into consideration, it seems ridiculous to assume that meteorological architecture -designed by architects with a mere high school understanding of physics - is anything but - formal predetermination. This work seems far more interesting when viewed as what it actually should be labeled as: a pop-cultural science fiction far away from plain science. Approaching architectural temporality as a form of 'Science' means to design meaningless compromise-ariums. Today's climactic formalism is nothing but an appendix to 1990s ideas of natural imitation. The lesson learned from the discussion about bio-mimicry in the 90's should have been that biomorphic formalism is NOT equivalent to an intelligent, living, biological system. Yet, climate architecture is rendered as the neutral and organic approach towards design. Interest in environments and biologies is above all a cultural phenomenon born out of an inner desire to connect architecture to nature. But, 2012 is not the 1990's anymore, meaning: no need to justify an interest in voronoi by pseudo-scientifically pointing out their 'bio-efficient structural logic' or to justify an interest in temporality, flows and processes by rendering it 'Science'. "The voronoi is not a virgin scientific object derived from nature, but rather a culture-nature artifact. Our new culture-nature artifacts (like e.g. the voronoi) are inherently linked to ideas of resemblance, a concept which Michel Foucault describes as the 'episteme' of classical thought. As such, they have the potential to re-introduce autonomy into the discourse about environment and ecology in architecture: "The nature of things, their coexistence, the way in which they are linked together and communicate is nothing other than their resemblance. And that resemblance is visible only in the network of signs that crosses the world from one end to the other. 'Nature' is trapped in the thin layer that holds semiology and hermeneutics one above the other; it is neither mysterious nor veiled, it offers itself to our cognition."⁴⁷ Humans are the producers of nature; in turn, nature does not need to be the sole producer of architecture! A cloud alone makes no building - or, it should not.

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How does climate?



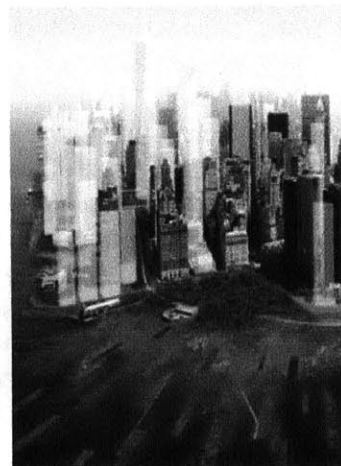
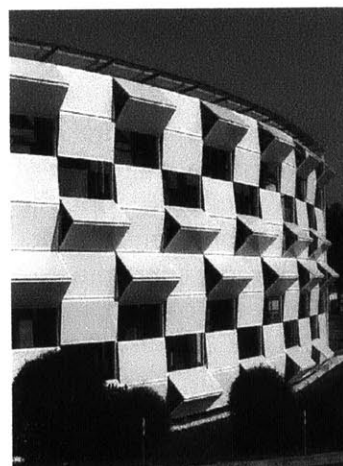
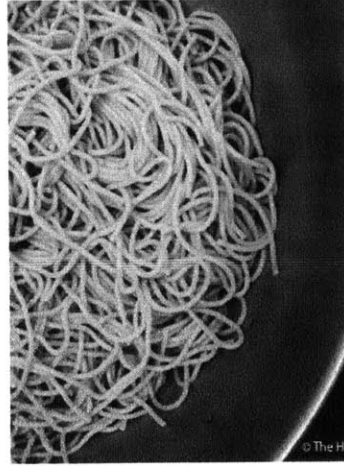
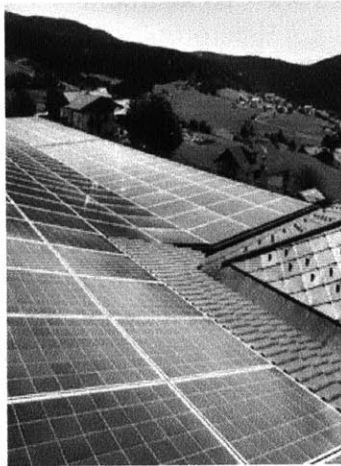
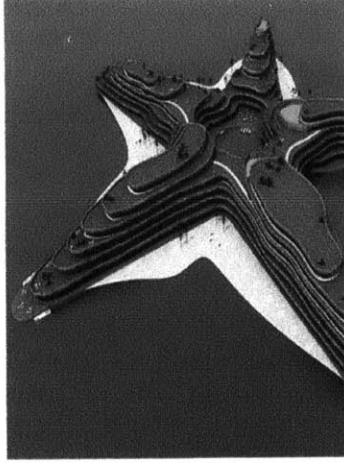
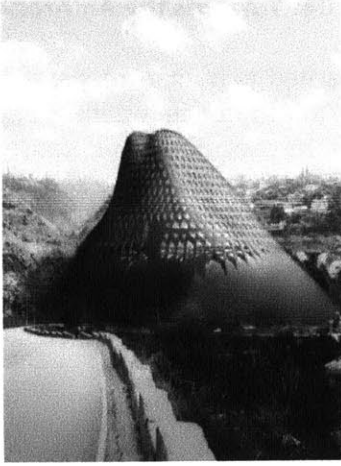
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"Climate Architecture"

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Chapter 04: Towards the Anthropocene!

“‘Nature’ on Earth is already ‘adapted’ to human intervention to such an extent – human ‘pollution’ being already deeply implicated in the shaky and fragile equilibrium of ‘natural’ reproduction on Earth – that its cessation would cause cataclysmic imbalance.”xlvi
(Slavoj Zizek, Living in the End Times)

04 a . Chernobyl – Welcome in disordered territories!

Of all messed-up places in the world, it is Chernobyl which best resembles the paradoxes of the Anthropocene. The ‘Chernobyl Exclusion Zone (CEZ)’ is a ‘man-made,’ highly contaminated, yet surprisingly ‘natural’ land of blossoming ecology. It is dangerous, but looks fabulously harmless. Chernobyl is void of people but filled with the remains of their civilization. A democratic neo-environmental “New Babylon”⁴⁹ of total freedom. Tarkovsky’s metaphysics of ‘The Zone’⁵⁰ come true. Chernobyl is the dystopic utopia for ecologists and environmentalists. A Heterotopia par excellence. The place where nature ideologies clash. A place where architecture seems ridiculous!

Chernobyl spans a territory of disorder in which formerly steadfast predeterminations open up towards new possibilities because of the latent inadequacy to engage in any standard definitions, norms and rules. Yet, this does not mean that an investigation in Chernobyl is irrelevant for other scenarios; Chernobyl is in fact an ubiquitous condition. The CEZ merely manages to enhance states of disorder – rendering them more visible. Chernobyl is a paranoid paradise of opportunity: It produced an environment in which fear of contamination seems so endemic that it might enable the production of novel aesthetics for the uncanny. It is the ultimate test site for contamination-paradoxes, autonomous environments or production of natures. It is the place to test the anthropocene constitution. In Chernobyl, architecture cannot differentiate between ‘man-made’- or ‘natural’ deterritorialization and disorder: Every process is simultaneously natural, man-made, intoxicated, hybrid, static, radioactive, restrictive, politically liberating, and potentially authoritarian.

The downright absurdity of Chernobyl comes with its expansive, intercontinental, de-territorial intoxication of territory. Today, 25 years after the catastrophe, a major part of Europe is still 137-Cs contaminated due to the massive reactor fallout of 1986. Contamination from Chernobyl can be measured in Canada, Japan and probably even in the International Space Station. Many places outside the CEZ are actually more contaminated than sites in immediate vicinity to the reactor. Any project in a European context, might address the same site specific issues of a project in Chernobyl. The CEZ constitutes a conceptual as well as physical reality which reaches far beyond its little 30 kilometer Exclusion Zone. Remote contamination is toxic de-territorialization at its best. Welcome to the Anthropocene! Welcome in disordered territories!

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Chapter 04: Towards the Anthropocene!

04 b . Temporality: the anthropocene state of being

If one assumes that principles of contamination will become the new “primary vessel of meaning”⁵¹ for the production of anthropocene environment, architecture, ecology, society, and culture (“nature-culture collectives”⁵²), then, understanding the reciprocity of processes in which those systems exchange and influence each other is a way to regulate and take authorship over what is currently acknowledged only as a passive by-product. Adapting processes of contamination as new architectural designators will prompt a redefinition of architectural ephemerality towards acknowledging the role of hybrids and collectives in the formation of temporal processes. In the Anthropocene, architectural ephemerality is both, a result and reaction to temporality. In the end, ephemerality becomes a colossal task: it sets the common ground for all possible nature-culture collectives. Within temporal processes of exchange, conflicting agendas meet, clash, conflict and overlap. The ephemeral is the playground of the anthropocene architect!

If anything, the ‘natural’ and the ‘man-made’ are related through an incredibly complex system of feedback loops resulting in a variety of social, ecological, political and environmental temporalities. Ultimately, temporal processes (‘cultural’ as well as ‘natural’) have to be rethought in terms of authorship and autonomy. Deleuze and Guattari raise the question about the autonomy of the nomad and his relation to ephemerality: “The nomad has a territory; he follows customary paths; he goes from one point to another; he is not ignorant of points (water points, dwelling points, assembly points, etc.). But the question is what in nomad life is a principle and what is a consequence. [...] The water point is reached only in order to be left behind; every point is a relay and only exists as a relay. [...] The nomad distributes himself in a smooth space; he occupies, inhabits, holds that space; that is his territorial principle. It is therefore false to define the nomad by movement; it is profoundly right to suggest that the nomad is on the contrary he who does not move.”⁵³ For the Deleuzian nomad, temporality is a state of being (for the contemporary architect, temporality is a state of panic and hysteria). When speaking of temporality, autonomy and authorship can only come from ‘not moving’ too much. We need to ask: If the Anthropocene is the principle, what is the consequence for architecture?

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Nomads



Chapter 04: Towards the Anthropocene!

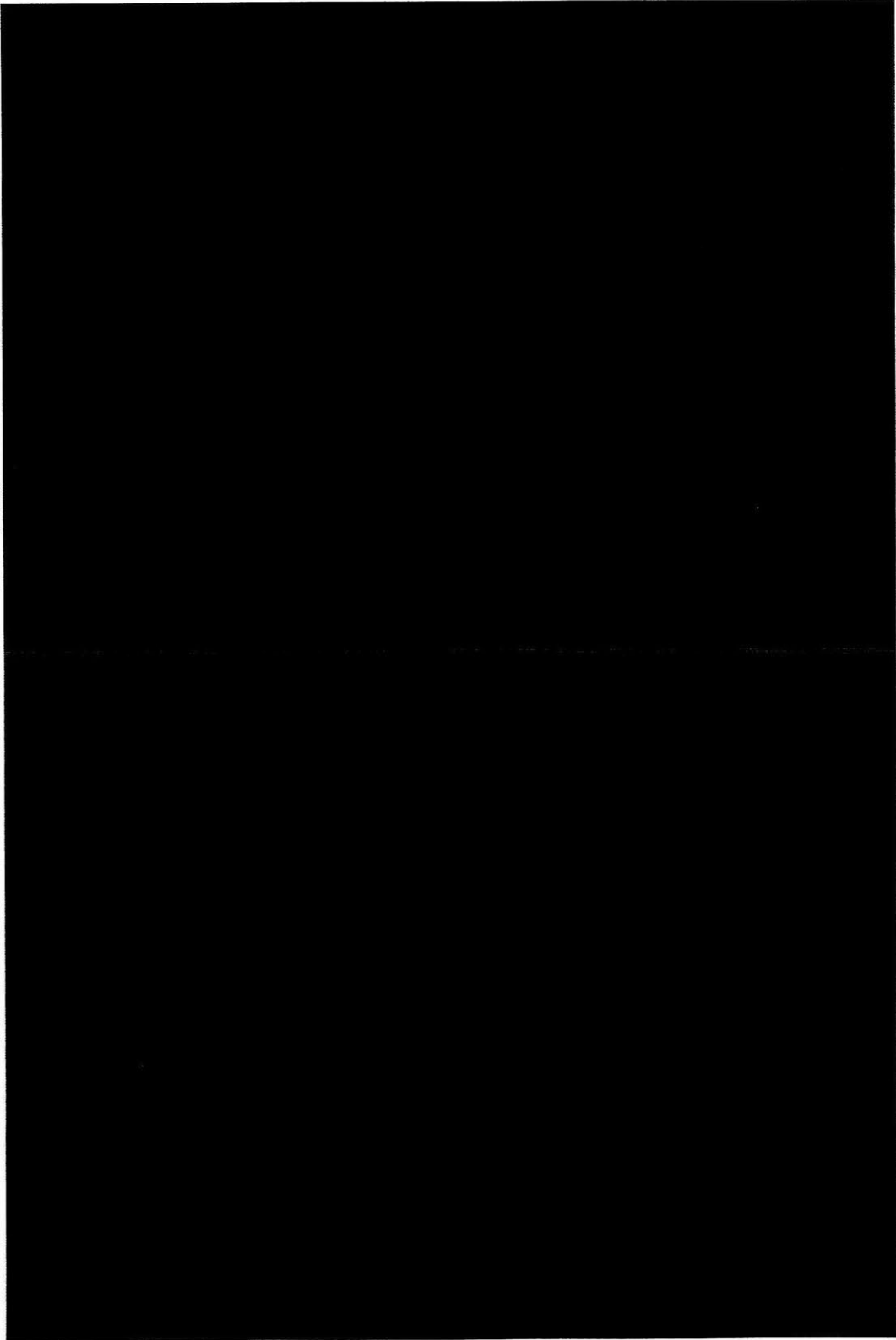
04 c . And now?

Manifesting a singular, unified architectural anthropocene destiny is as naïve as hoping that other forms of organizing environment, ecology or territory can “guarantee an open society or equality in politics”. “While there are constraining architectures, there are no specifically liberating architectures. ‘Liberty’, [Foucault] says, ‘is a practice.’”⁵⁴

Remains only to continue dealing with a diverse “spaghetti” of systems, networks, ecologies, natures, hybrids, and bio-morphisms. Yet, this time acknowledging a significant (maybe revolutionary) change of principle: the paradigm shift towards the Anthropocene.

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Chapter 02
Thesis Preparation .
02 c . Project Research

Thesis Preparation . Project Research

**Site Analysis - Fallout conditions
The Chernobyl reactor catastrophe**

The reactor catastrophe of Chernobyl had a vast impact on areas in direct vicinity to the power plant as well as it affected large territories in Europe. The fallout cloud contaminated forests, agricultural land, settlements and cities across a whole continent. Radiation levels varied strongly, depending on local influences such as rainfall, topography or type of soil. The released radioactivity was approximately 500 times that of Hiroshima after the first deployed nuclear bomb in history destroyed the entire city

Time-line of a disaster: the story of reactor block IV

The Chernobyl accident occurred on April 26, 1986 at around 1:24 am in reactor block number IV of the Chernobyl power plant. The reactor cooling system has been turned off due to a security test (the experiment was supposed to simulate a fatal incident). The shutdown of cooling capacity resulted in an uncontrollable chain reaction, culminating in a series of steam explosions within the reactor itself.^{xix} The reactor and its emergency systems (especially its cooling mechanism) were completely destroyed by the explosions. The consequent reactor fire lasted for ten days. It is estimated that about 3.0% of the total reactor content were released into the atmosphere.^{xx}

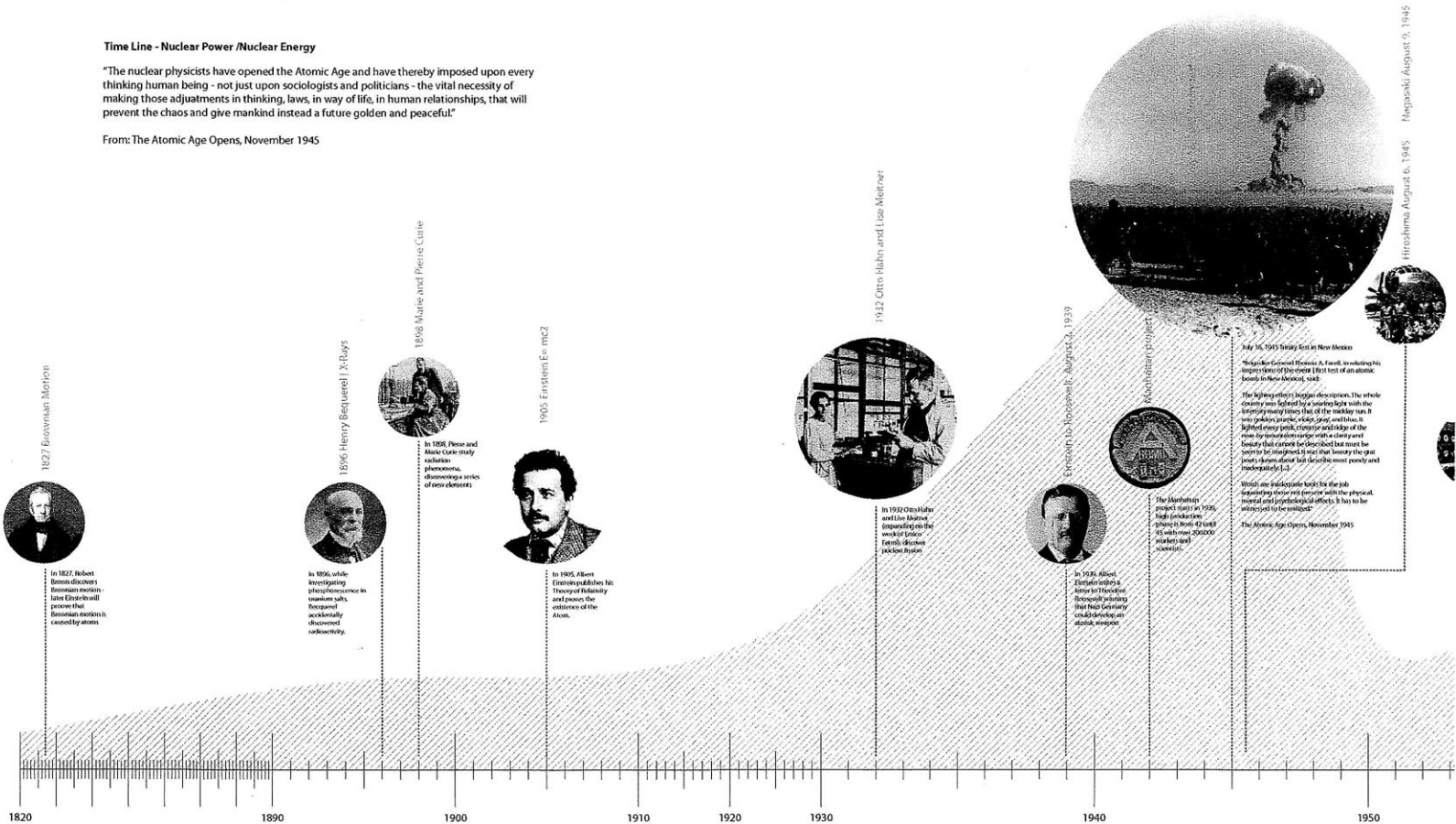
The city of Pripyat with its 45000 inhabitants was evacuated on April 27, one day after the incident occurred. It was decided to evacuate people and cattle from an area of 30 km around the reactor on May 2 and within four days after the accident, the Chernobyl Evacuation Zone (CEZ), still existing today, was established. Overall it is estimated that about 350000 people in the most affected countries Ukraine, Belarus and Russia had to be evacuated due to radioactive contamination of the environment.^{xxi} Today, five million people continue to live in areas affected by radioactive contamination, coping with the social, environmental, health and economic consequences. ^{xxii}

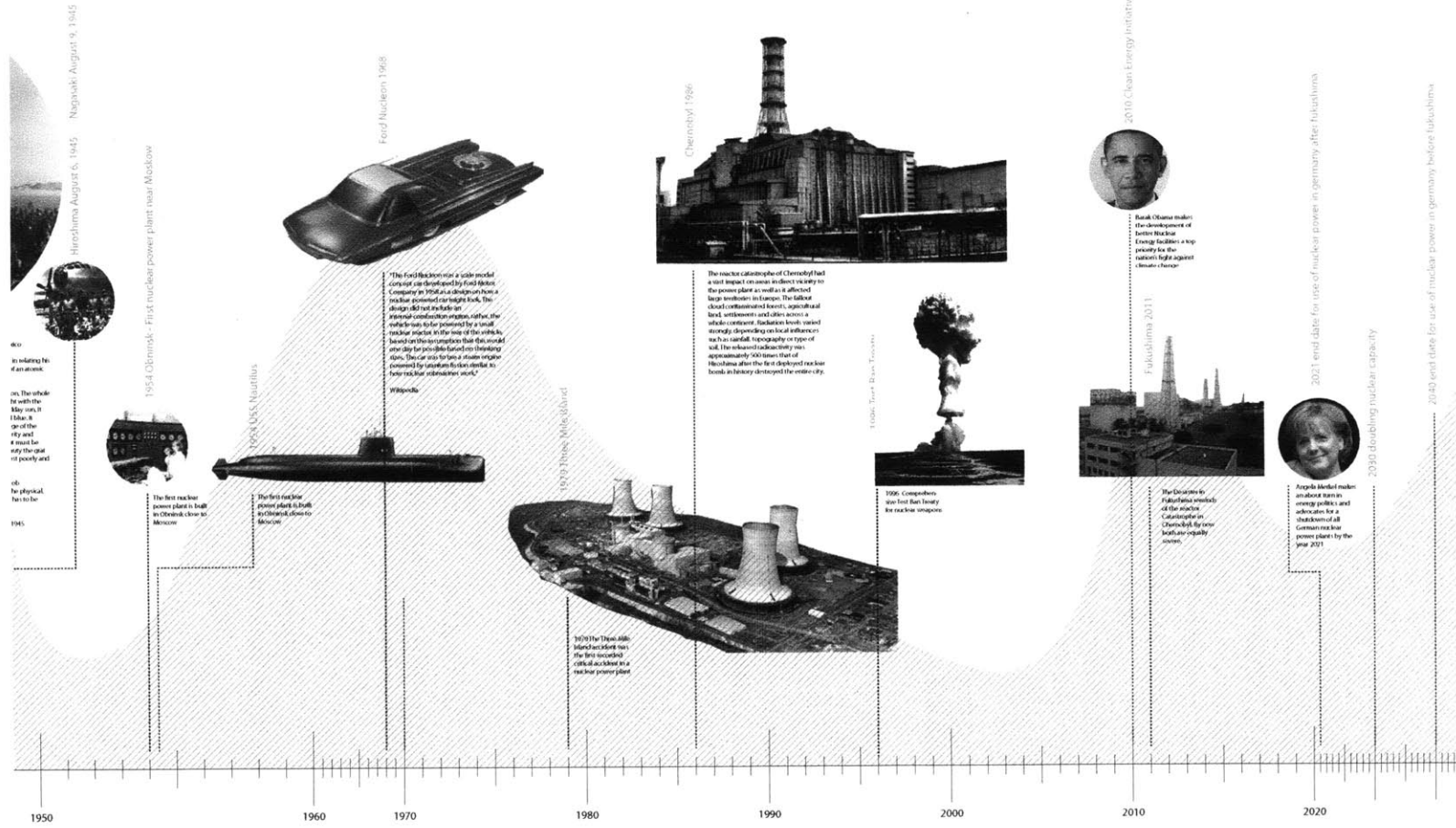
About 240,000 so called "liquidators" were involved in mitigation activities within the most contaminated areas and directly on site at the power plant.^{xxiii} According to the International Committee on Radiological Protection, more than 4600 thyroid cancer cases related to radioactive contamination have been reported in Belarus, Ukraine and Russia.^{xxiv} Other reports estimate the total number of cancers and casualties with 15,400 (US Academy of Sciences) or up to 76,000 (J. Gofman).^{xxv} It should be mentioned that expert numbers and opinions vary drastically on almost any subject related to the accident. This might partially be explained by political motivation – Chernobyl as an environmental disaster has always been politicized by lobbyists, environmentalists



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**Site Analysis - Fallout conditions
Catastrophe Tourism**

Tour program:

9 a.m. Pick up at your hotel/apartment (for an individual tour) or meeting near Kozatsky hotel at Independence Square (for a group tour) with other group members.

10.30 a.m. Transfer to Chernobyl passing Dytyatky village at the border of the 30-km Chernobyl Zone. Passing the check point on the border of 10-km Zone. Meeting the representative of Chernobylinterinform Agency.

Arrival to Chernobyl town. Information regarding the Chernobyl tragedy, borders of the Zone, life in Chernobyl nowadays. Up-to-date information about the liquidation of the Chernobyl catastrophe consequences in the 30-km Zone, most contagious places, machines, cemeteries. Forecast for the future.

Trip around the Nuclear Power Station. Photo-stop near the Reactor No 4 of the former station with the view on the sarcophagus. You will be only 100 m from the main cryptic object of the Zone!

You will be driven nearby to the "red forest", which was left for scientific researches.

Trip to Pripyat - "The Dead (Ghost) Town" walking, visiting one of the tallest buildings – Polissya Hotel; a school, a kinder garden, former living houses, which are absolutely empty now. You will see the town that was left by its 50 thousand inhabitants within 24 hours. The spirit of Soviet darkness reigns here. You can make pictures of the National Emblem of the Soviet Union and of Soviet Ukraine, slogans 'Peace, Labor and May', red-yellow public call-boxes and other objects that were symbols of the 80's in the Soviet Union. Additionally, you will visit a Central Park with a big Ferris Wheel. They planned to open this big Ferris Wheel on 1 May 1986 (public holiday). This big Ferris Wheel has never seen its visitors. Pripjat is similar to a mummy. It has a body but it doesn't have a soul.

03.30 p.m. Ecologically clean Dinner at Chernobyl (all food is delivered from Kiev). [!!!!!!]

Optional visit of Opachychi village to meet and talk to resettles.

Observation tour in Chernobyl Town, visiting the river port, Ilinskaya Church, Glory Park, examples of machinery, which took part in liquidating the results of the Chernobyl accident.

Transfer to Kiev. Return to Kiev around 06.00 p.m.

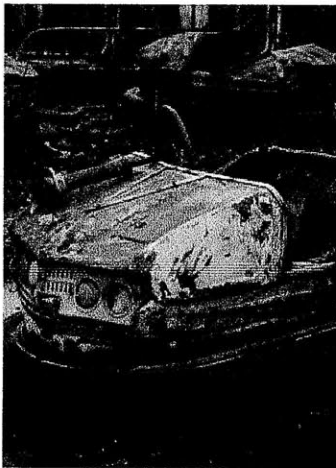
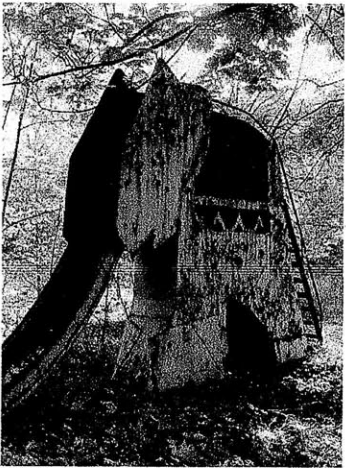
This is an all-inclusive, English guided Chernobyl tour.

It includes: Kiev pick-up and drop-off, Zone access pass and transportation, English guide, lunch.

source: <http://stayinkiev.com/en/Chernobyl-Tour>

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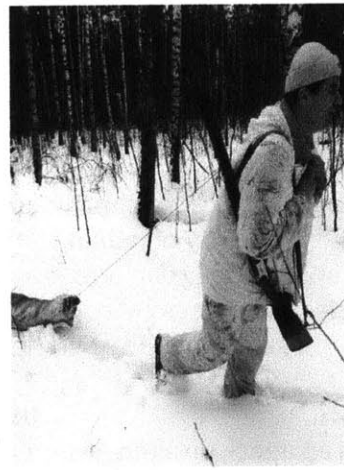
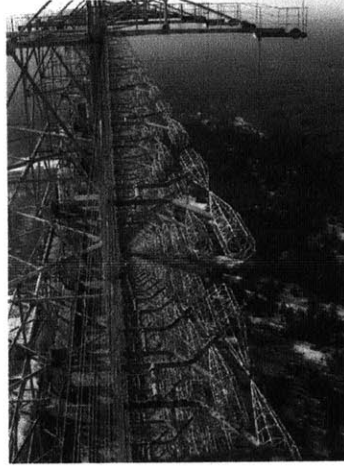




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Site Analysis - Fallout conditions

Site Paradoxes: uninhabitable but natural? (excerpt from Mushroom discourse)

Environmental catastrophe – for whom?

The IAEA states that within sites which have been abandoned by human population, “significant population increases of game mammals (wild boar, roe deer, red deer, elk, wolves, foxes, hares, beavers) and bird species were observed soon after the Chernobyl accident.”^{lxxii} In fact, large parts of the CEZ have become a (contaminated) wildlife reserve in the last 25 years. For large parts of the CEZ contamination will make any return of non-temporal human inhabitation impossible for hundreds of years to come. Chernobyl has produced many paradoxes such as the return of wildlife and nature into a “unnatural”, and dangerous environment. It’s externalities remain intangible and even though there have been hundreds of scientific publications on the topic, the catastrophe remains highly controversial. Nevertheless, the Chernobyl catastrophe has raised - and continues to raise - awareness about other energy related externalities while serving as a catalyst for environmental debate.

01 Thirty kilometers of exclusion – certified territory of pollution?

While the site of the accident is clearly marked by a 30 km exclusion zone, it’s effective impact on the environment happens on a much larger scale. In fact, Chernobyl has produced a multiplicity of sites and polluted territories. The analysis of mushroom populations has reveals large environmental cycles and their relation to transmission of contamination.

02 Toxic nature – natural refuge?

The discourse about toxicity raises the question about the evaluation of energy externalities. The (almost heretical) question if toxicity can result in positive externalities has to be brought up within a society that produces its own nature and nature-hybrids. Can nature be saved through pollution within sites of human exodus?

03 Natural mushroom – healthy mushroom?

‘Risk Society’ has produced natural products such as forest mushrooms which have been ‘denaturalized’ through excessive pollution. Today, the pure, clean and safe mushroom comes from the mushroom factory.

04 Invisible radionuclide – visible nuclear catastrophe?

The invisibility of radionuclides as the main source of contamination renders this catastrophe socially dangerous and environmentally severe. At the same time the rather easy scientific detectability of radiation is a prerequisite for revealing large scale horizontal and small scale vertical relationships within environments and ecologies.

05 Catastrophe – natural at last?

In an attack on a romantic reading of nature as a harmonic entity, Slavoj Zizek points out that “nature is a series of mega catastrophes” and “nature, in the sense of a harmonious nature is ‘dead’ ”.^{lxxiii} Maybe the polluted, animal paradise of the CEZ challenges the common ideology of pristine nature-ecology after all?

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Site Analysis - Fallout conditions Maps and facts

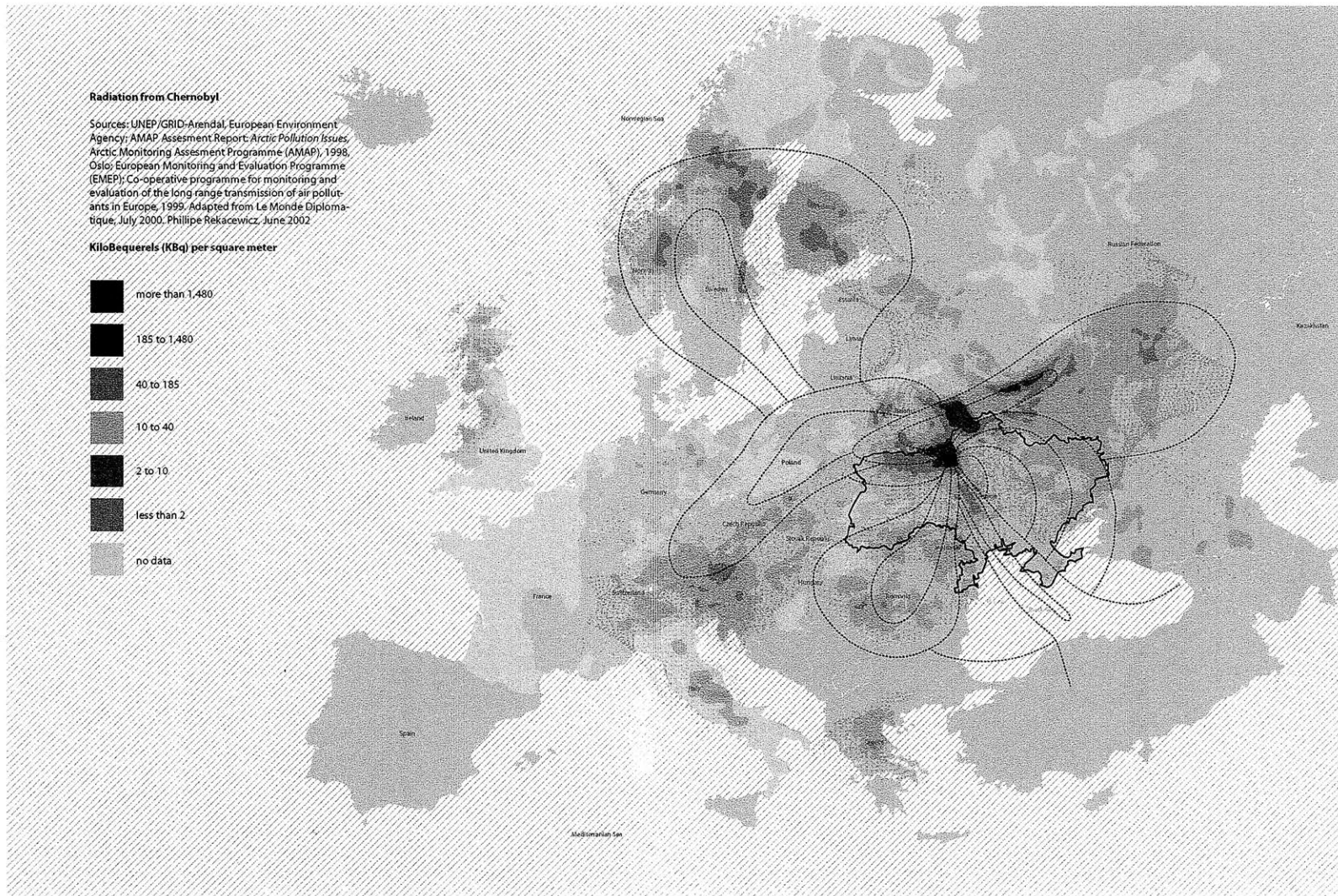
Continental traces: meteorology in April and May 1986

First traces of the explosion in reactor number IV of the Chernobyl power plant outside the USSR were found on April 28 in the clothing of a technician at the Forsmark nuclear power plant in Sweden.^{xxvi} Due to the alarmingly high levels of radiation it was first suspected that leakage had occurred within the reactor in Forsmark itself. Later that day, the same distressing signals came from reactors and control stations in Norway, Finland and Denmark. At this point, Sweden confirmed that the source of radiation had to be outside the country.

The prevailing winds in those days transported air from the Black Sea, across Ukraine, over the Baltic and into Scandinavia. It was though suspected that there must have been a severe nuclear incident within the borders of the former USSR. It took the soviet officials six hours to respond to urgent requests about the source of radioactive contamination. At 9:00pm local time, a telecaster on Moscow television read an official statement from the Council of Ministers: "An accident has taken place at the Chernobyl power station, and one of the reactors was damaged. Measures are being taken to eliminate the consequences of the accident. Those affected by it are being given assistance. A government commission has been set up."^{xxvii} In the following eight days, the radioactive cloud contaminates vast areas of Europe. It first crosses Scandinavia and Britain, then parts of Poland, Czechoslovakia, Bavaria, Austria and North Italy. After that it turns towards Belarus and Russia before it finally contaminates large areas in Ukraine, Romania and Hungary. The radioactive cloud carried large quantities of different radionuclides, most importantly Iodine 131, Cesium 134 and Cesium 137.^{xxviii} As far as Japan and the US, relatively high concentrations of radionuclides were measured.

The so called "fallout", a combination of a passing radioactive cloud with local rainfall led to uneven contamination in affected regions. Both, the varying levels of radioactive concentration within the cloud as well as local environmental conditions influenced ground contamination. Overall, contamination occurred quite unpredictably but, "especially in areas where rain fell while the radioactive cloud was passing, pollution by Cs-137 was remarkable." The Chernobyl accident – seen isolated as a singularity - spatially exceeded any other man made environmental disaster in scale. Yet, it should be mentioned that Chernobyl is one of the few environmental disasters that, due to its very specific type of contamination, can be easily measured, monitored and assessed as a singularity at all. Theoretically, every externality which pollutes the air should produce similar effects.





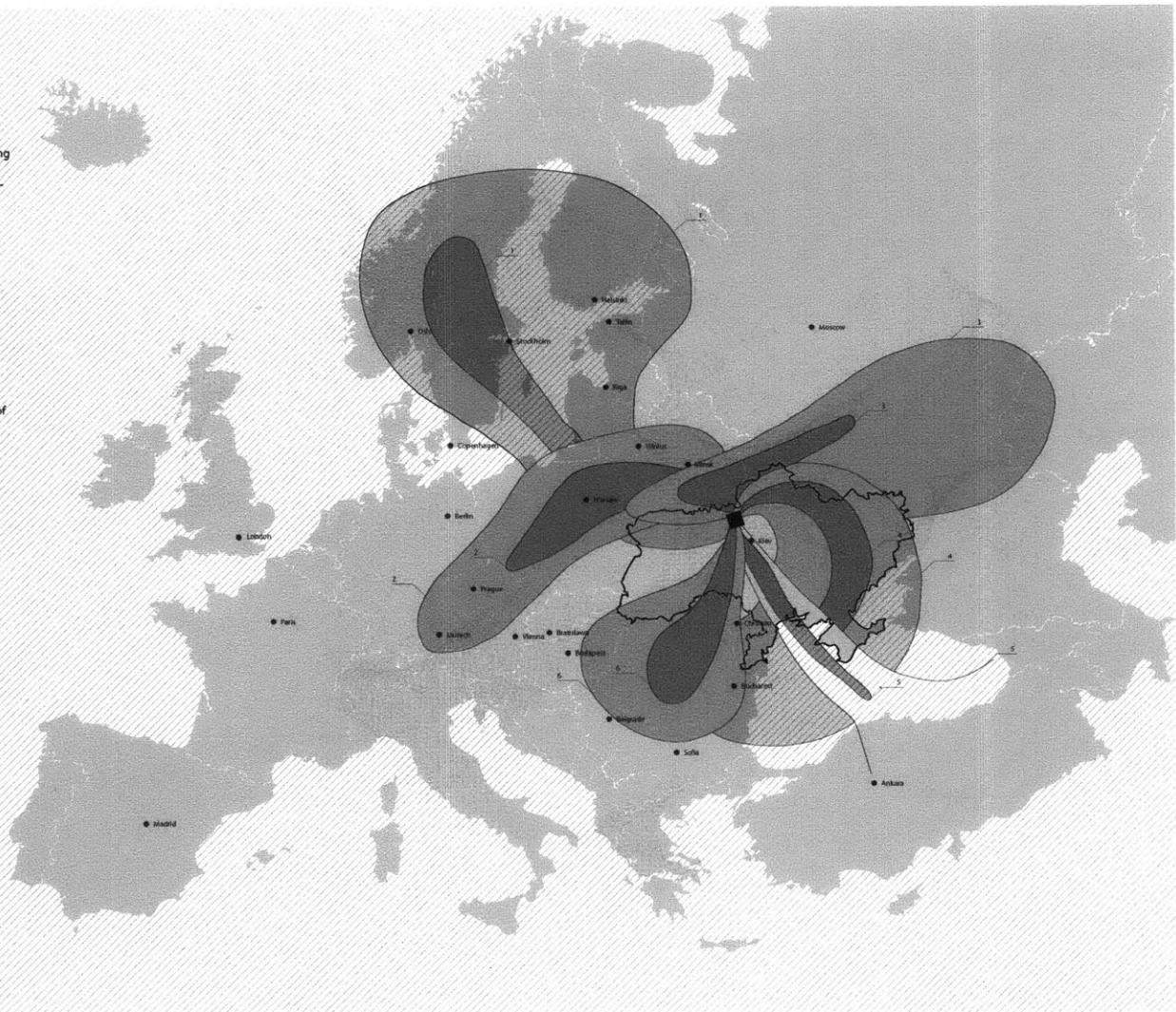
**Chernobyl Fallout Cloud | April 26
until May 4 1986**

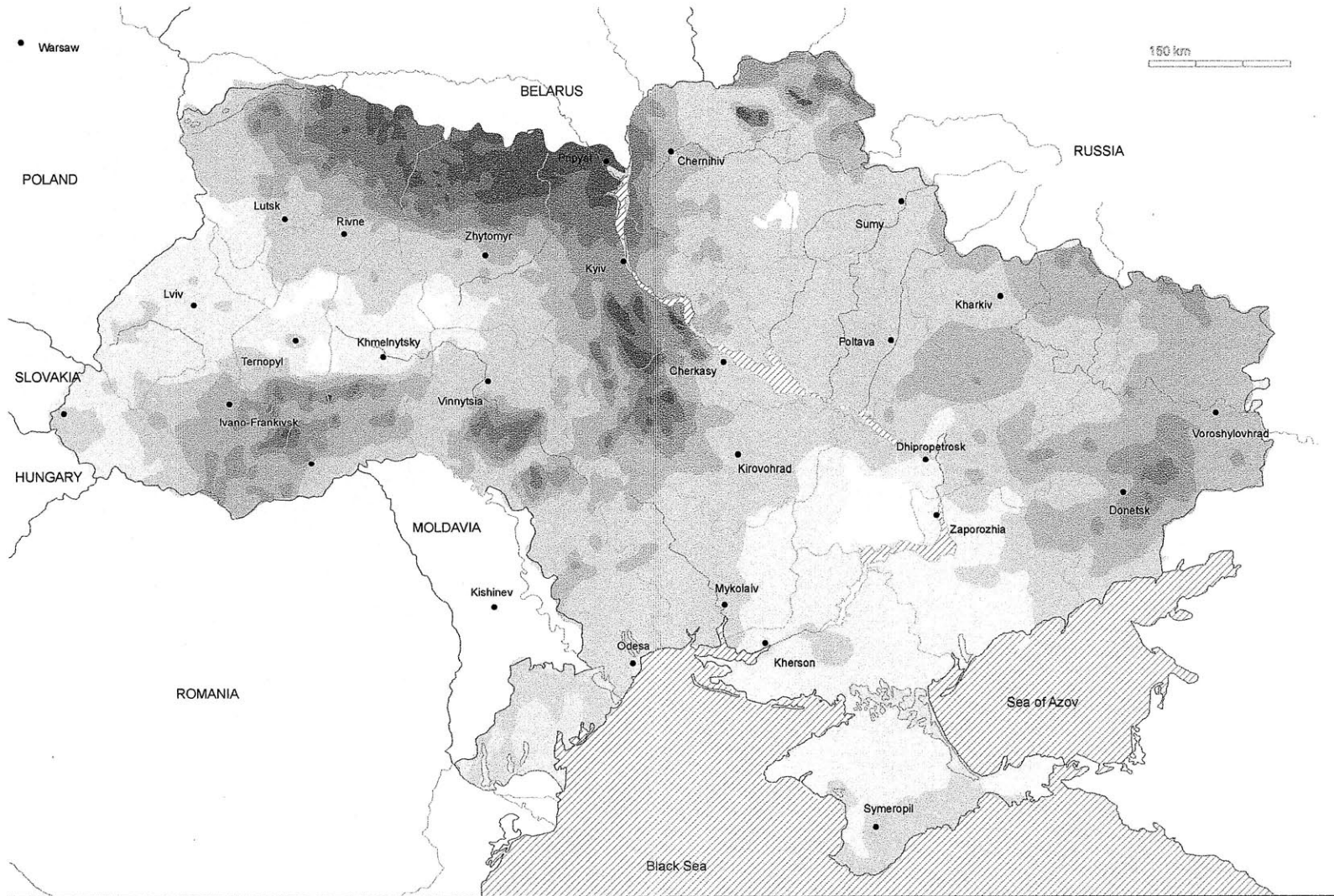
Calculated plume formation according
to meteorological conditions for
instantaneous releases on the follow-
ing dates and times (GMT):

- (1) 26 April, 00:00
- (2) 27 April, 00:00
- (3) 27 April, 12:00
- (4) 29 April, 00:00
- (5) 2 May, 00:00
- (6) 4 May, 12:00

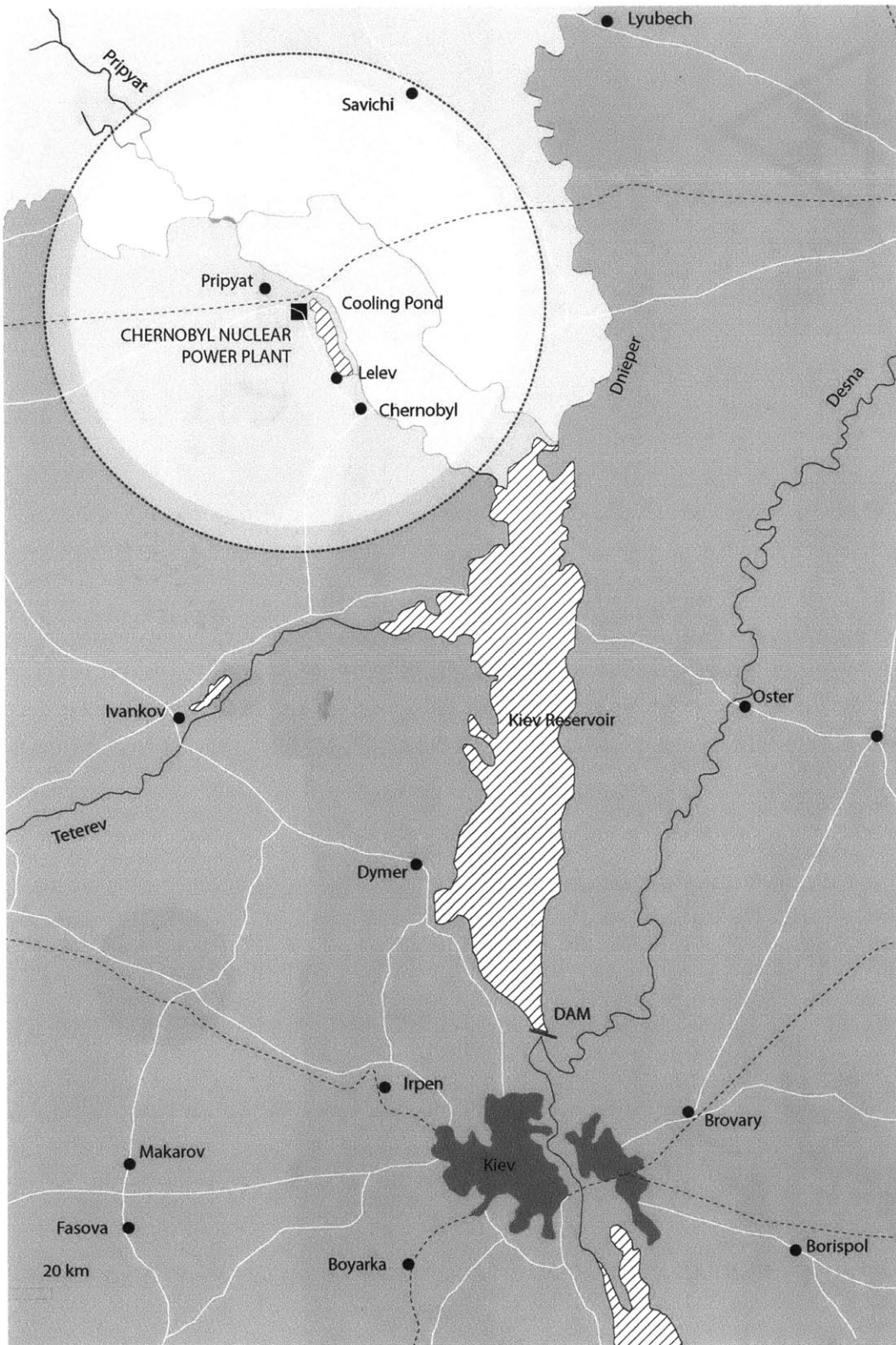
(Borsilov and Klepikova 1993).

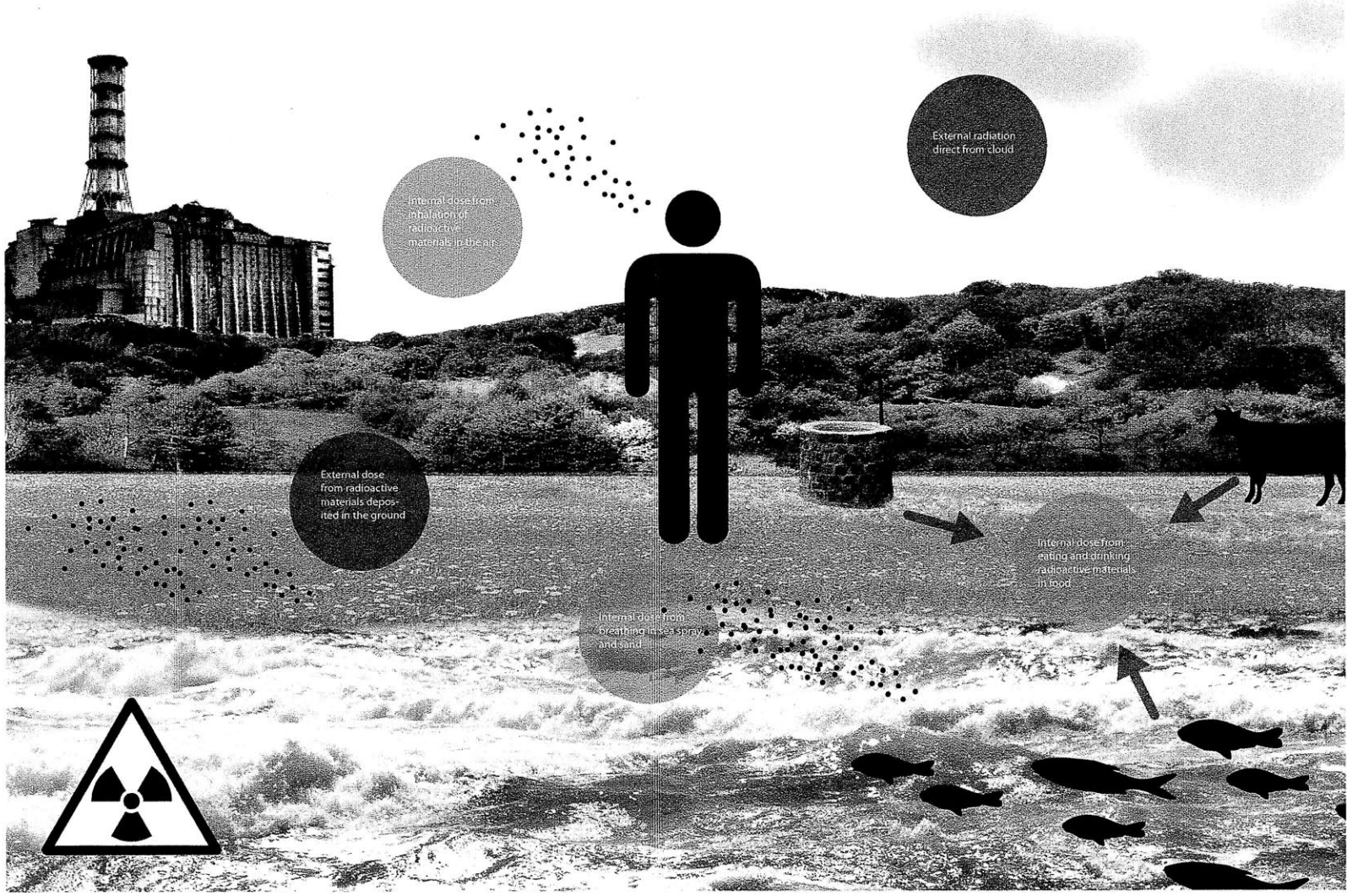
Data from: IAEA. Environmental
Consequences of the Chernobyl
Accident and their Remediation:
Twenty Years of Experience. Report of
the Chernobyl Forum Expert Group
'Environment'. (Vienna, 2006), pp 38



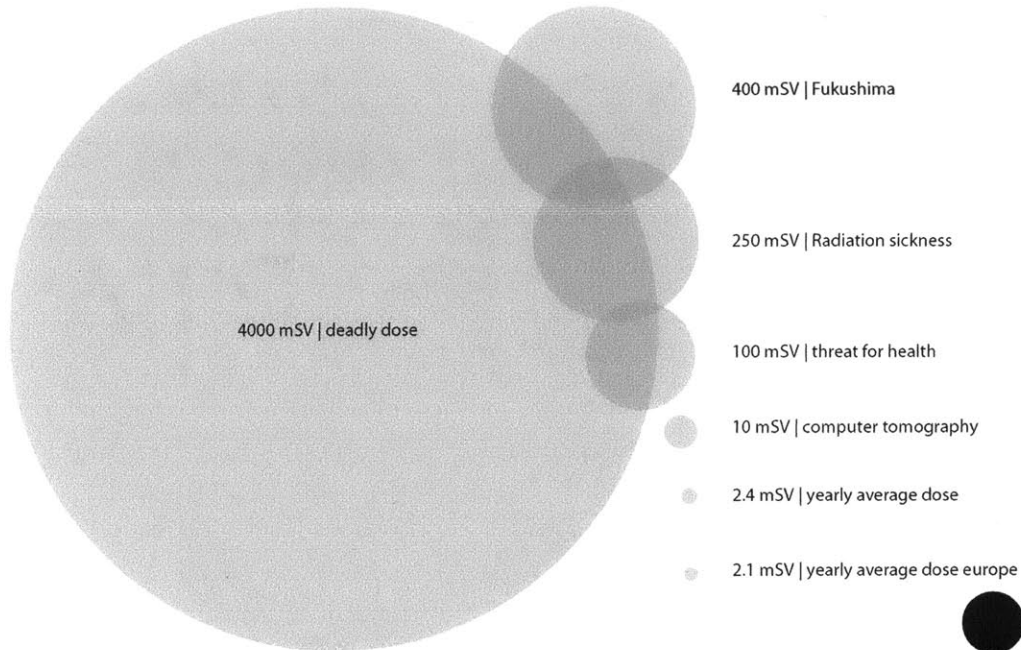


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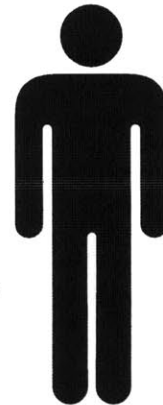


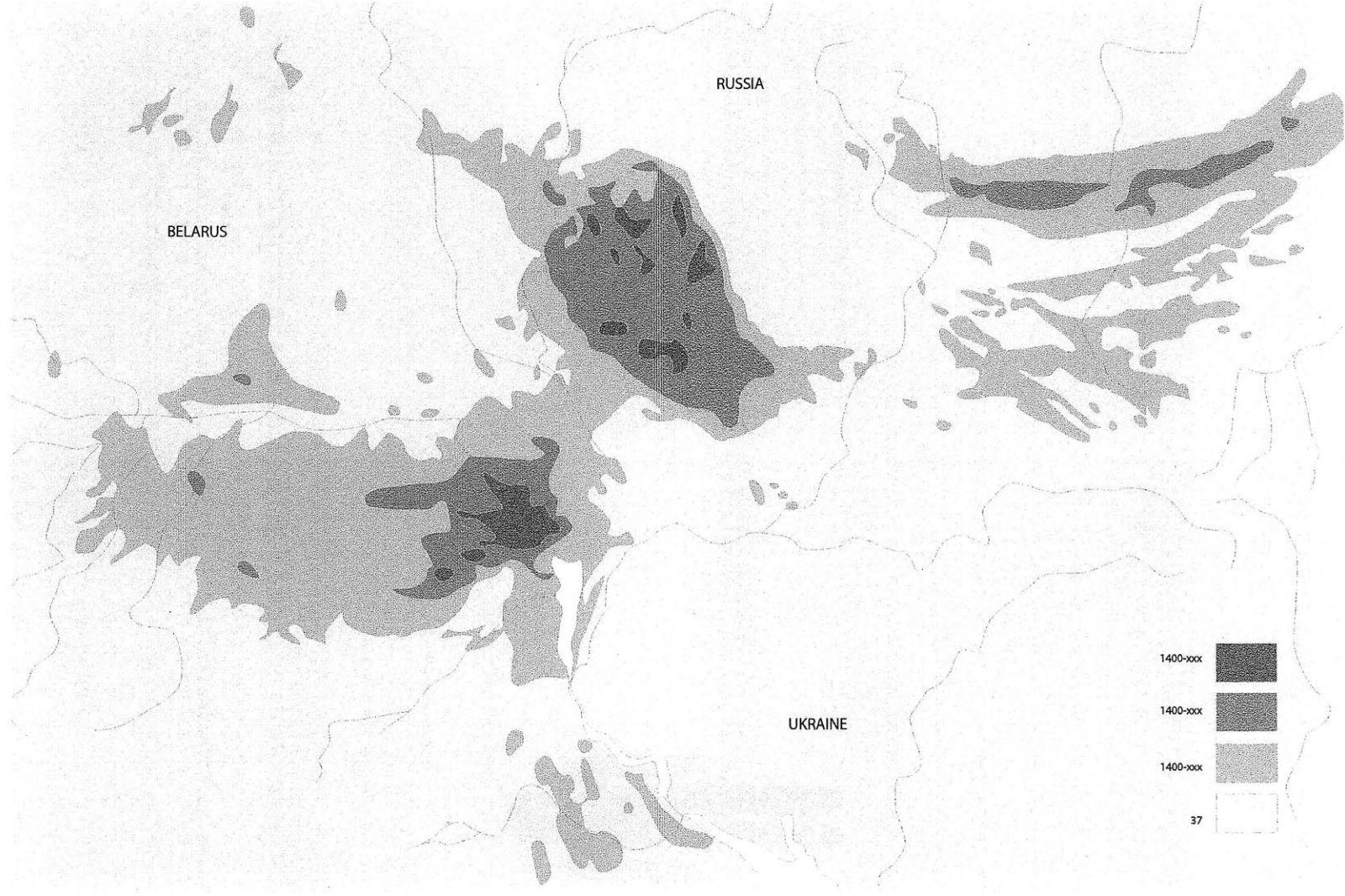
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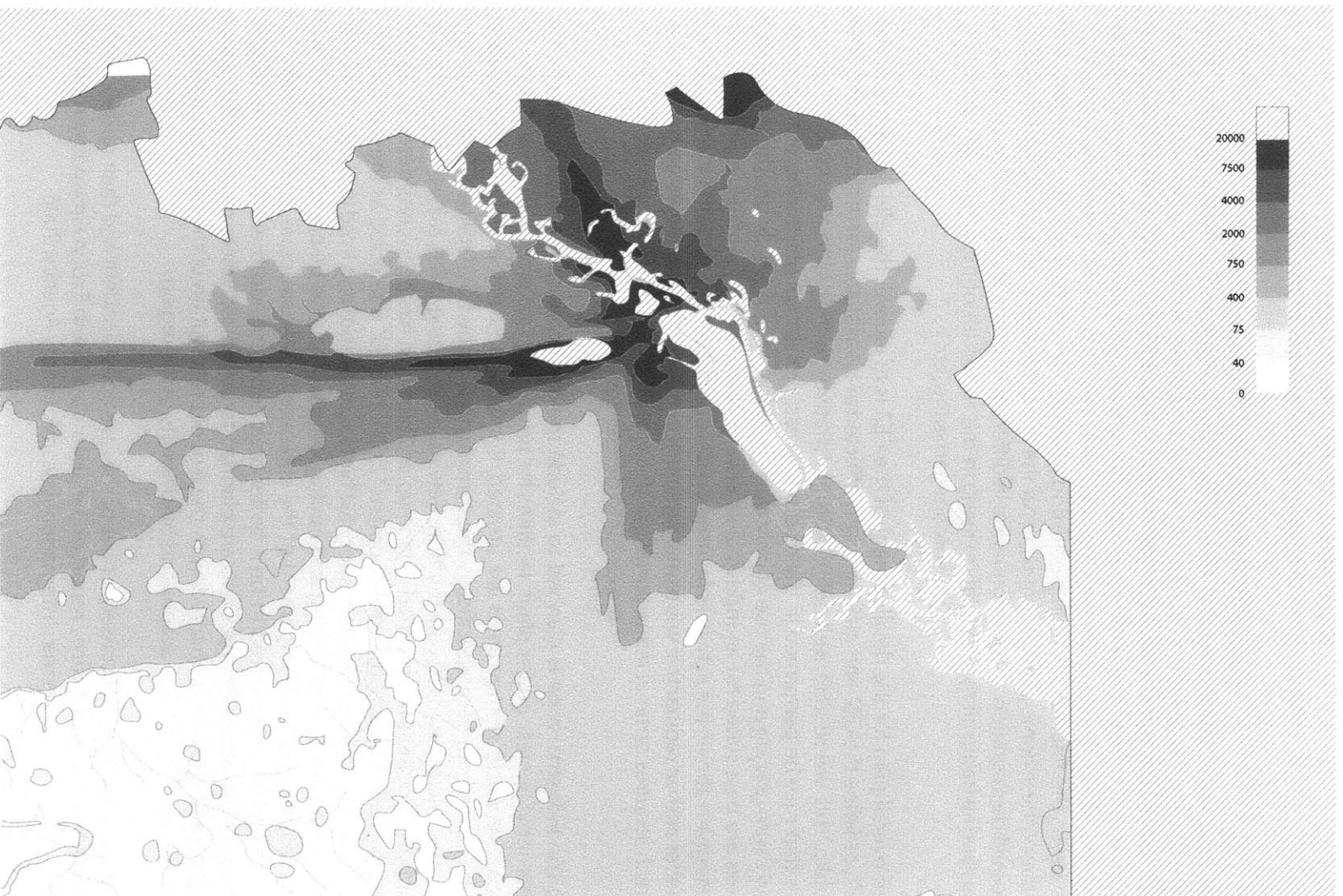
sample radiation doses (<http://en.wikipedia.org/wiki/Sievert>)

Maximum acceptable dose for the public from any man made facility: 1 mSv/year
Dose from living near a nuclear power station: 0.0001–0.01 mSv/year[
Dose from living near a coal-fired power station: 0.0003 mSv/year
Dose from sleeping next to a human for 8 hours every night: 0.02 mSv/year[
Dose from cosmic radiation (from sky) at sea level: 0.24 mSv/year[
Dose from terrestrial radiation (from ground): 0.28 mSv/year
Dose from standing in front of the granite of the United States Capitol building: 0.85 mSv/year
Average individual background radiation dose: 2 mSv/year; 1.5 mSv/year for Australians, 3.0 mSv/year for Americans
Dose from atmospheric sources (mostly radon): 2 mSv/year
Total average radiation dose for Americans: 6.2 mSv/year
New York-Tokyo flights for airline crew: 9 mSv/year
Current average dose limit for nuclear workers: 20 mSv/year
Dose from smoking 30 cigarettes a day: 60–80 mSv/year





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**Site Analysis - Fallout conditions
Outlook on the future development of the CEZ**

Future Of The Chernobyl Exclusion Zone

The long term development of the CEZ is an important and complex task that must consider various technical, economic, social and other factors; various options have been considered for the evolution of this zone. According to Likhtarev et al. [7.35], after 2015 about 55% of the territory around the Chernobyl nuclear power plant could be considered for release from radiological limitations according to Ukrainian legislation. However, the final decision on permitting people to return to this zone must take into account the inhomogeneous character of the contaminated land, specific features of radionuclide migration and accumulation in different portions of the local landscape, and the routine habits of the population living in this region (hunting, fishing, berry picking, mushroom gathering, etc.).

The overall plan for the development of the CEZ is to recover the affected areas of the CEZ, redefine the CEZ and make the non-affected areas available for resettlement by the public. This will require well defined administrative controls as to the nature of activities that may be performed in the resettled areas, prohibition of growing of food crops and cattle grazing and the use of only clean feed for cattle. Accordingly, these resettled areas are best suited for an industrial site rather than for a residential area. For the reasons given above, the activities focused on decontamination and dismantlement of the shelter and on radioactive waste management in this territory are expected to continue, which requires optimal management of this area. The new concept foresees division of the CEZ into different sections:

(a) The industrial zone is planned to include the most contaminated areas, where the Chernobyl nuclear power plant, facilities for processing radioactive waste and main radioactive waste storage areas are situated. Primarily industrial activities are envisaged to be carried out here, specifically the construction of the NSC facilities. To provide the infrastructure for NSC construction, new roads, shipping yards, railways and other support structures are planned. The town of Chernobyl has been considered as an option for such infrastructure development [7.6]. If the CEZ is selected as the site for construction of the geological repository for high activity and long lived radioactive waste, a significant amount of drilling and mining work will have to be performed, which will also require specific development of the engineering infrastructure. (b) The sanitary restricted zone is considered to be a buffer area between industrial and nature reserve areas. (c) The nature reserve areas are planned to be located where most industrial and human activities are prohibited, with the aim of preservation of the basic natural landscapes and biodiversity of the region.

Source: Environmental consequences of the Chernobyl accident and their remediation : twenty years of experience / report of the Chernobyl Forum Expert Group 'Environment'. — Vienna : International Atomic Energy Agency, 2006.



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**Project Brief
Program**

This thesis advocates to take advantage of the planned revitalization of the Chernobyl Exclusion Zone by proposing a visitor center, animal shelter, research station and anthropology institute worthy of new geological times! (one building)

Visitor center:

The comfortable programming choice: 300 years from now, the CEZ will be the most 'natural' piece of land on Earth. Today the site is facing catastrophe tourism. Soon, Chernobyl's mutated nature will be the main attraction.

architectural organization similar to a small lodge hotel / exhibition gallery (a bit like jurassic parc)

Animal shelter:

Equal right for everyone: decontaminated artificial natures serve as animal shelters (of course, those landscapes make it easier to observe wildlife as well)

architectural organization: mase-like zoo (open)

Research station:

Founded by the IAEA, the Japanese Government and MITEI, the research center is a top-notch research facility. At the current rate, a nuclear disaster happens every 25 years. Researching the CEZ is important to better cope with abandoned fallout territories in the future.

The research center is also a significant political force. The nuclear lobby who finances the whole project, is currently most concerned with the bad image of nuclear energy. The industry's good name is at stake and needs to be redeemed.

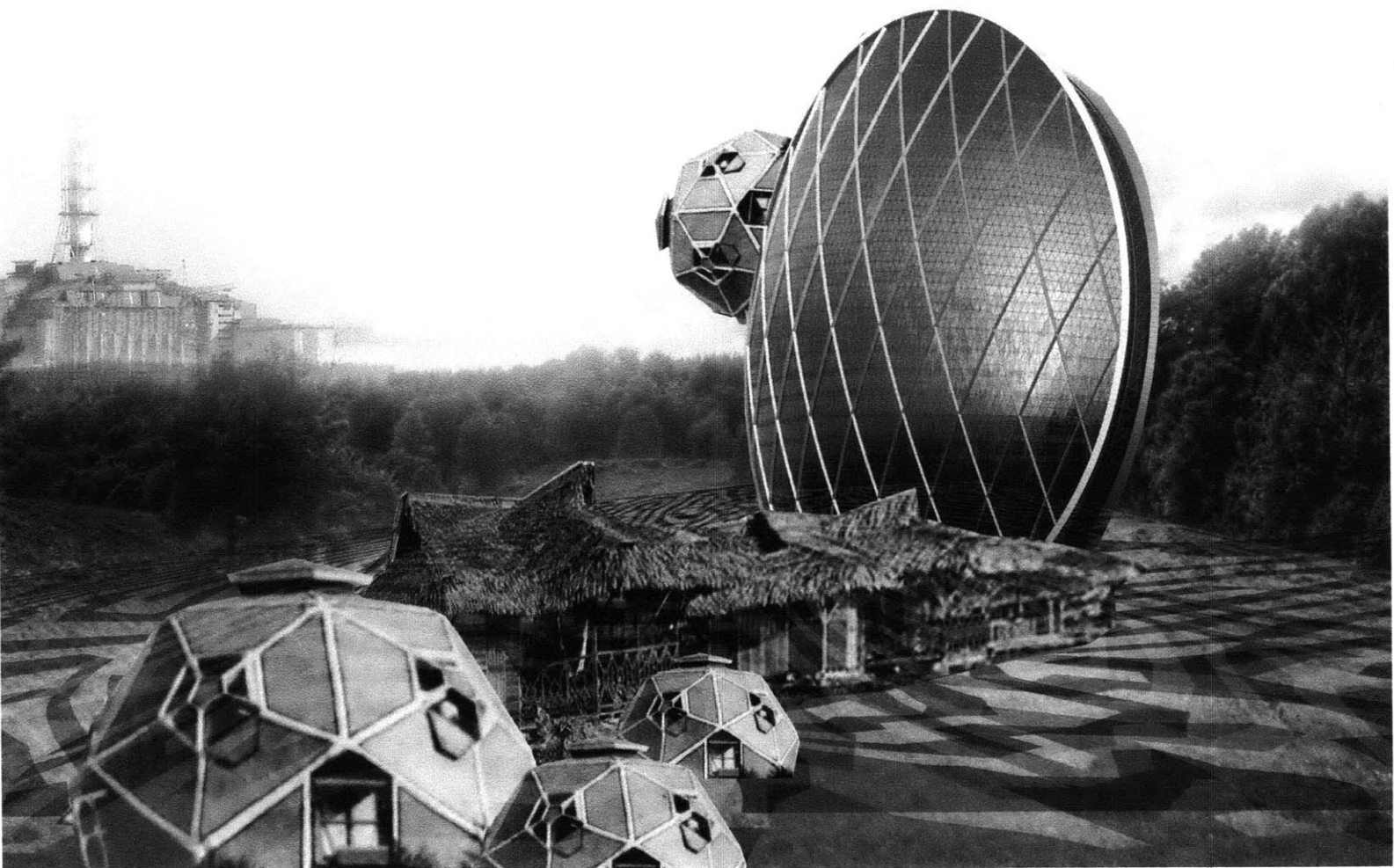
architectural organization: headquarter tower

Anthropology Institute:

Interdisciplinary research facility researching the effects of colossal ephemerality on 'culture', 'society', ecology, environment, etc. In the Anthropocene, all of those fields are now part of anthropological studies.

architectural organization: drop city

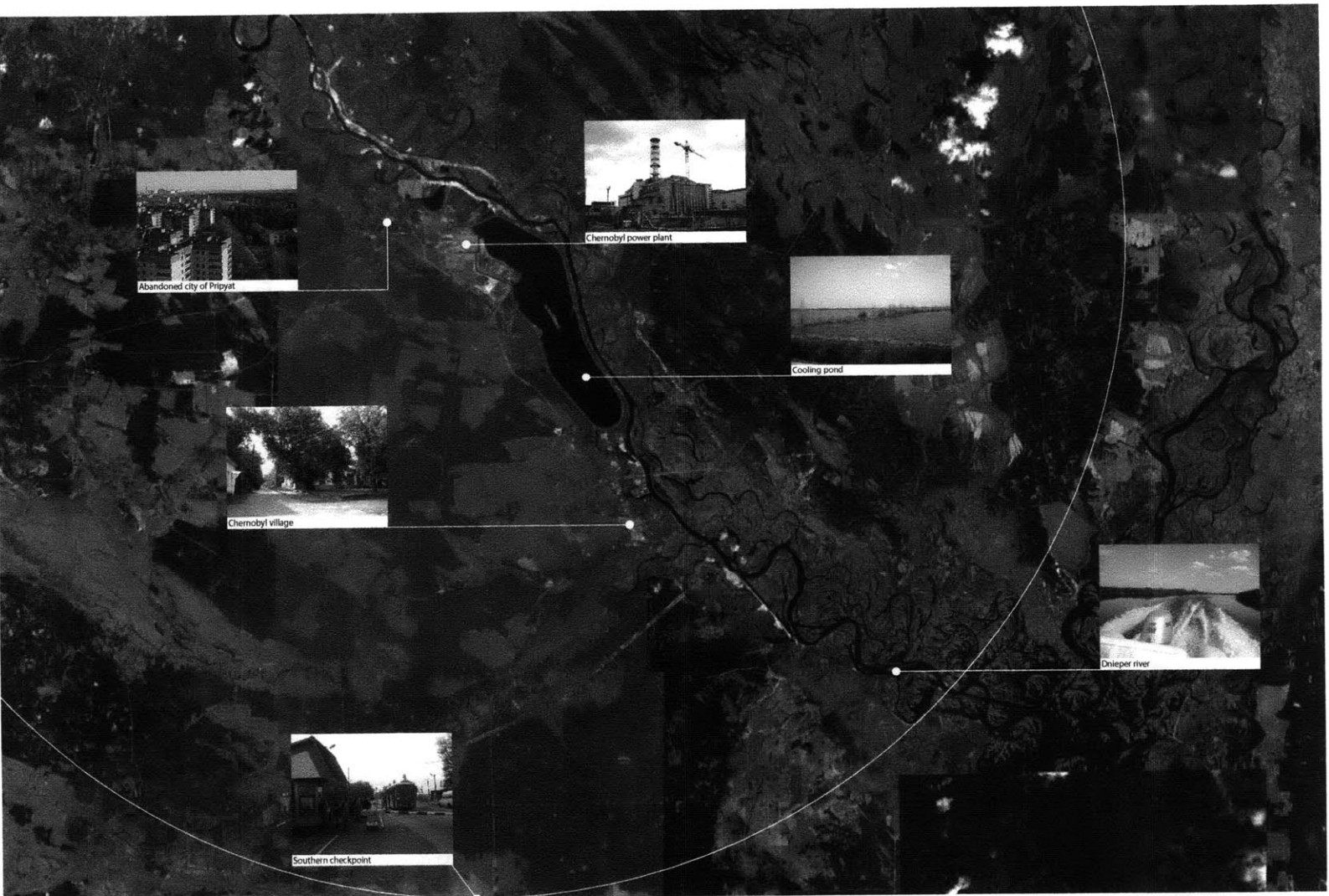
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Project Brief
Potential sites and scales of operation

Site visits do not work as planned in Ukraine. Two days before heading out to Kiev, the Chernobyl Exclusion Zone was temporarily closed for tourists. Up until today it is not known why. Some say it was due to excessive illegal hunting in the zone, others claim there was a problem with the reactor, the list is almost endless. Today, visits to Chernobyl are possible again.

Analyzing google earth satellite footage, I have outlined some interesting structures, patterns, shapes and forms within the CEZ. Some patterns are quite interesting because they clearly blur the distinction between 'man-made' and 'natural' structures in the landscape.





**“The Icon”
The abandoned ferris wheel in Pripjat**

Pripjat was about to have the traditional spring fair when catastrophe struck. Ever since, the abandoned ferris wheel became a powerful symbol for the abandonment of Pripjat.

- Tourist attraction no. 01 in Pripjat.



**“Wetland”
The wetlands of the Dnieper river**

“The Dnieper River is one of the major rivers of Europe (fourth by length) that flows from Russia, through Belarus and Ukraine, to the Black Sea. The total length is 2,285 kilometres (1,420 mi) and has a drainage basin of 504,000 square kilometres (195,000 sq mi). The river is noted for its dams and hydroelectric stations. The Dnieper is an important navigable waterway for the economy of Ukraine and is connected via the Dnieper-Bug Canal to other waterways in Europe.” (wikipedia)

The Dnieper river's has expansive wetlands begin at the edge of the CEZ and form one of the most important wildlife ecosystems in Europe.



"The Ghost City"
The abandoned city of Pripjat

"Pripjat is a ghost town near the Chernobyl Nuclear Power Plant in the Kiev Oblast (province) of northern Ukraine, near the border with Belarus. The city has a special status within the Kiev Oblast, being the city of oblast-level subordination (see Administrative divisions of Ukraine), although it is located within the limits of Ivankiv Raion. The city also is being supervised by the Ministry of Emergencies of Ukraine as part of the Zone of Alienation jurisdiction.

Pripjat was founded in 1970 to house workers for the Chernobyl Nuclear Power Plant. It was officially proclaimed a city in 1979 but was abandoned in 1986 following the Chernobyl disaster. It was the ninth nuclear city ("атомград" (atomograd) in Russian, literally "atom city") in the Soviet Union at the time and its population was around 50,000 before the accident." (wikipedia)

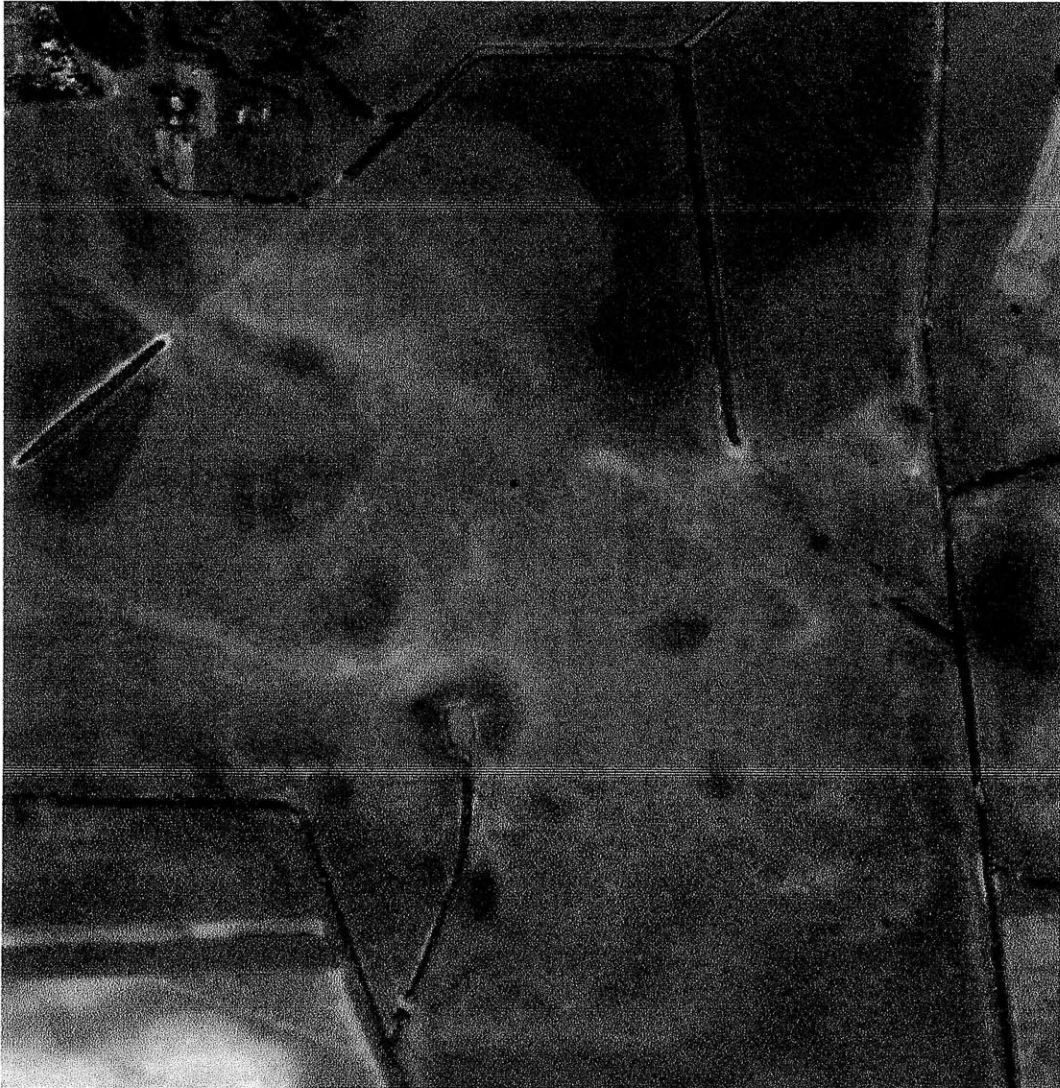
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**“The Man-made Infrastructure”
The Chernobyl power plant cooling pond**

Measuring about 11 kilometers in length, the cooling pond of the Chernobyl power plant is the most prominent man-made structure in the CEZ. The pond yields the potential for addressing and changing a large scale ecosystem within the zone.

The cooling pond might be re-mediated and put to different use.



"The Agricultural Infrastructure"
Agricultural ditches and water channels

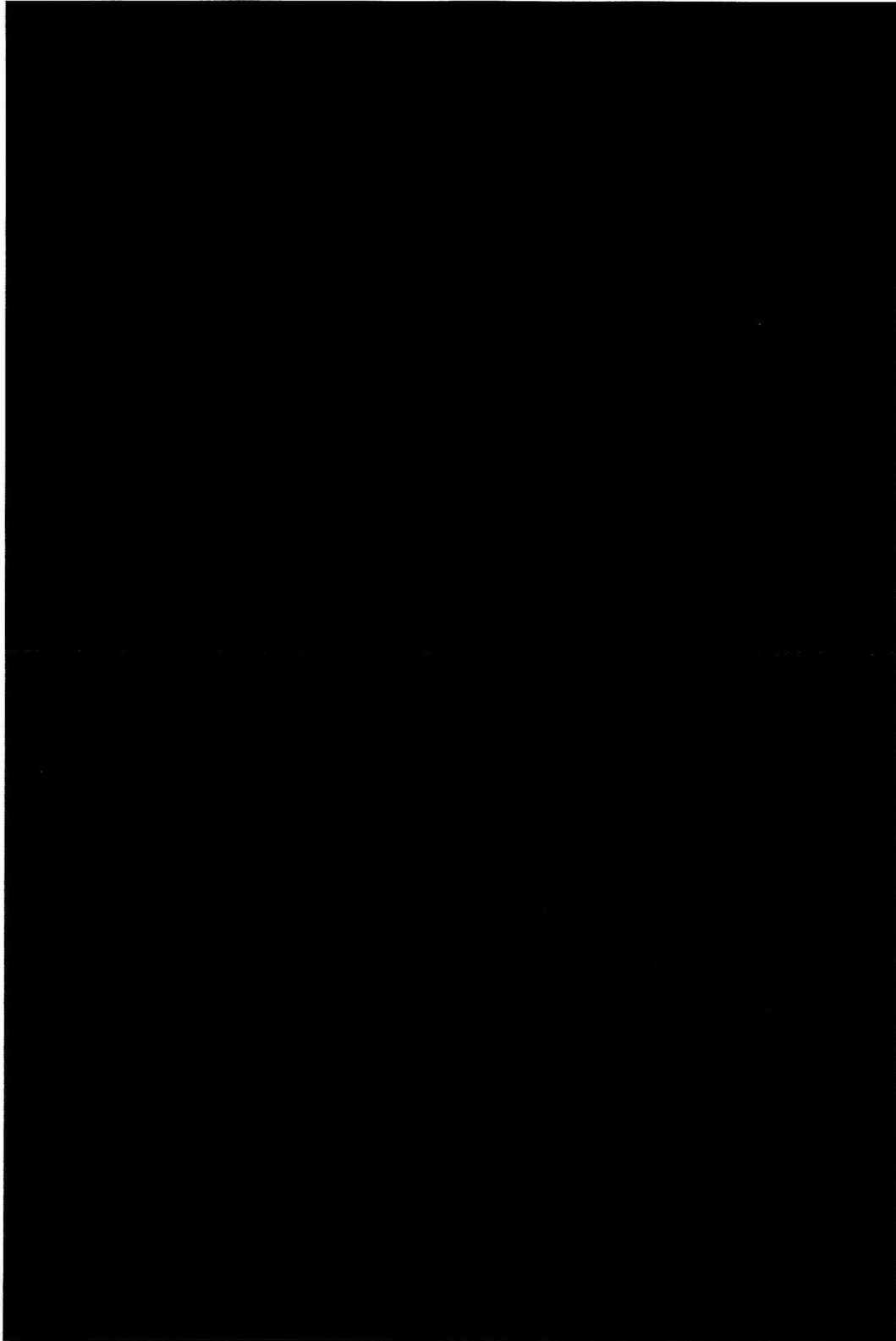
A large scale landscape re-mediation project could serve as a model project for integrating industry and other large scale infrastructures into the CEZ - protecting the absurd new form of nature which occupies the zone.



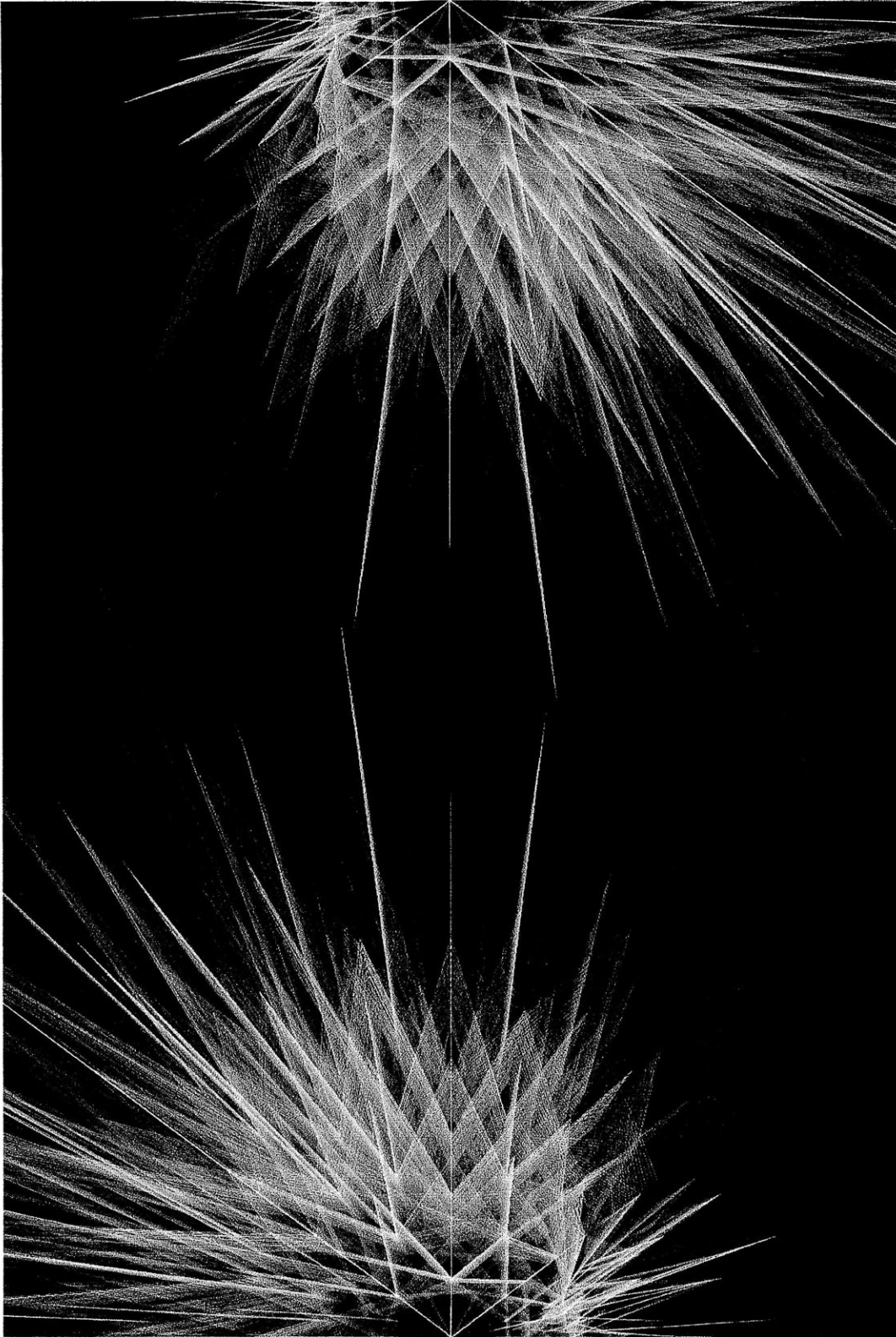
"The Immigration Office"
The southern control station

This is the point where contaminated territories begin and where clean and safe territories end. Incredible, but true: There exists a fence which separates healthy from mutated.

Contamination paradoxes can be addressed especially well at the edge of the CEZ.



Chapter 03
Milieus and Algorithms .
Independent Study



Chapter 03

Milieus and Algorithms.

Independent Study
www.milieus-and-algorithms.org

About this project

Milieus and Algorithms examines the relationship between geometry generating algorithms and algorithm controlling milieus. Processing, an open software project developed by Casey Reas and Ben Fry at MIT Media Lab is used to establish a set of rules for growth and expansions of geometries (algorithms) while at the same time allowing to alter the conditions which determine how things grow in real time (milieus).

Milieus and Algorithms studies the complexity of growing systems and their transforming part-to-whole relationships questioning former perceptions of the relationship between geometry and milieu. This study is an abstract testing ground, pushing the limits of the temporal relationship between architecture and the environment / ecology. Milieus and Algorithms is an Independent Study project which was developed by Sasa Zivkovic and supervised by Joel Lamere at Massachusetts Institute of Technology / MIT.

Algorithms and Milieus

In recent years, crisis prompted a discourse about the role of nature and ecology within the discipline of architecture. New fabrication techniques and computation tools allow for investigations into natural processes and ways to utilize nature's intelligence for architectural purposes. "Subnature", "Tooling", "Soft Space" are only a few recent publications which methodologically investigate processes of 'biomimickry' as a driver for re-imagining architecture's relationship with ecological systems and the environment.

This project seeks to take a slightly different approach towards describing and analyzing the relationship of geometry to its environment. In "Tooling", Aranda Lasch, describe (and praise) the incredible variability of snowflakes, ending up extracting only the internal logic of crystal growth, ignoring and neglecting the potential of addressing the reciprocity between the geometry of the crystal and the surrounding micro-environmental conditions.

Milieus and Algorithms aims to investigate the relationship between 'things' and 'environments' by studying growth processes. Within this investigation, feedback plays a key role in understanding the correlation between geometry generating algorithms [processing code] and algorithm controlling milieus [mouse input]. This study is an abstract testing ground, pushing the limits of the temporal relationship between architecture and the environment / ecology.

Milieus and Algorithms

Feedback

In 'Cybernetics', Norbert Wiener explains feedback by describing the process of picking up a pencil: 'Our motion proceeds in such a way that we may say roughly that the amount by which the pencil is not yet picked up is decreased at each stage. [...] To perform an action in such manner, there must be a report to the nervous system, conscious or unconscious, of the amount by which we have failed to pick up the pencil at each instant.'

Thus, feedback is the flow of information which updates and alters an action or operation based on a deviation from former information and parameters. In this Processing study, the mouse gives feedback to the drawing algorithm which in turn adjusts itself.

This reciprocity can generate an infinite amount of possible drawings, fields and objects.

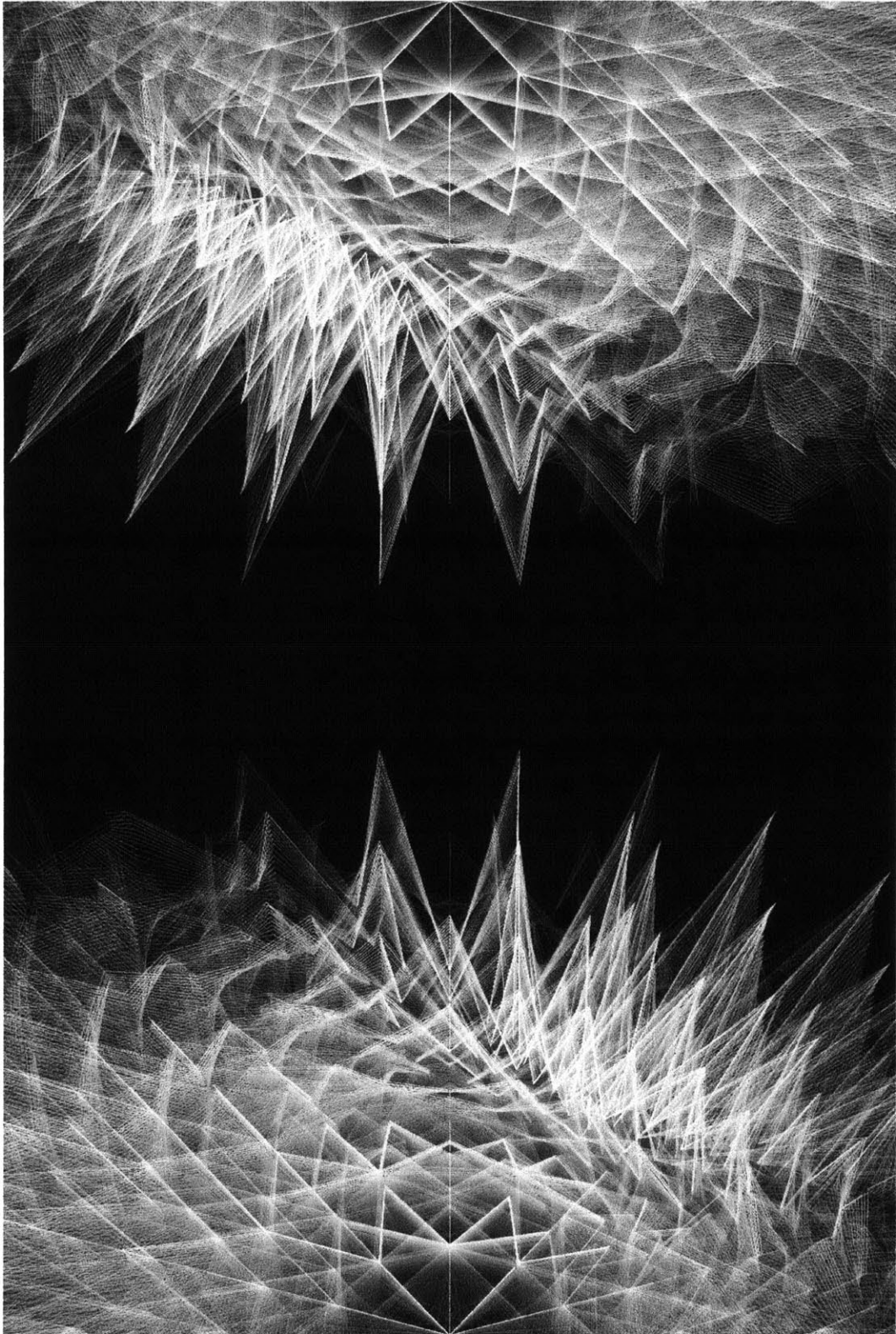
Feedback plays a key role in understanding the relationship between geometry generating algorithms [processing code] and algorithm controlling milieus [mouse input]. In other words: things and environments are inevitably related through feedback.

Conclusion

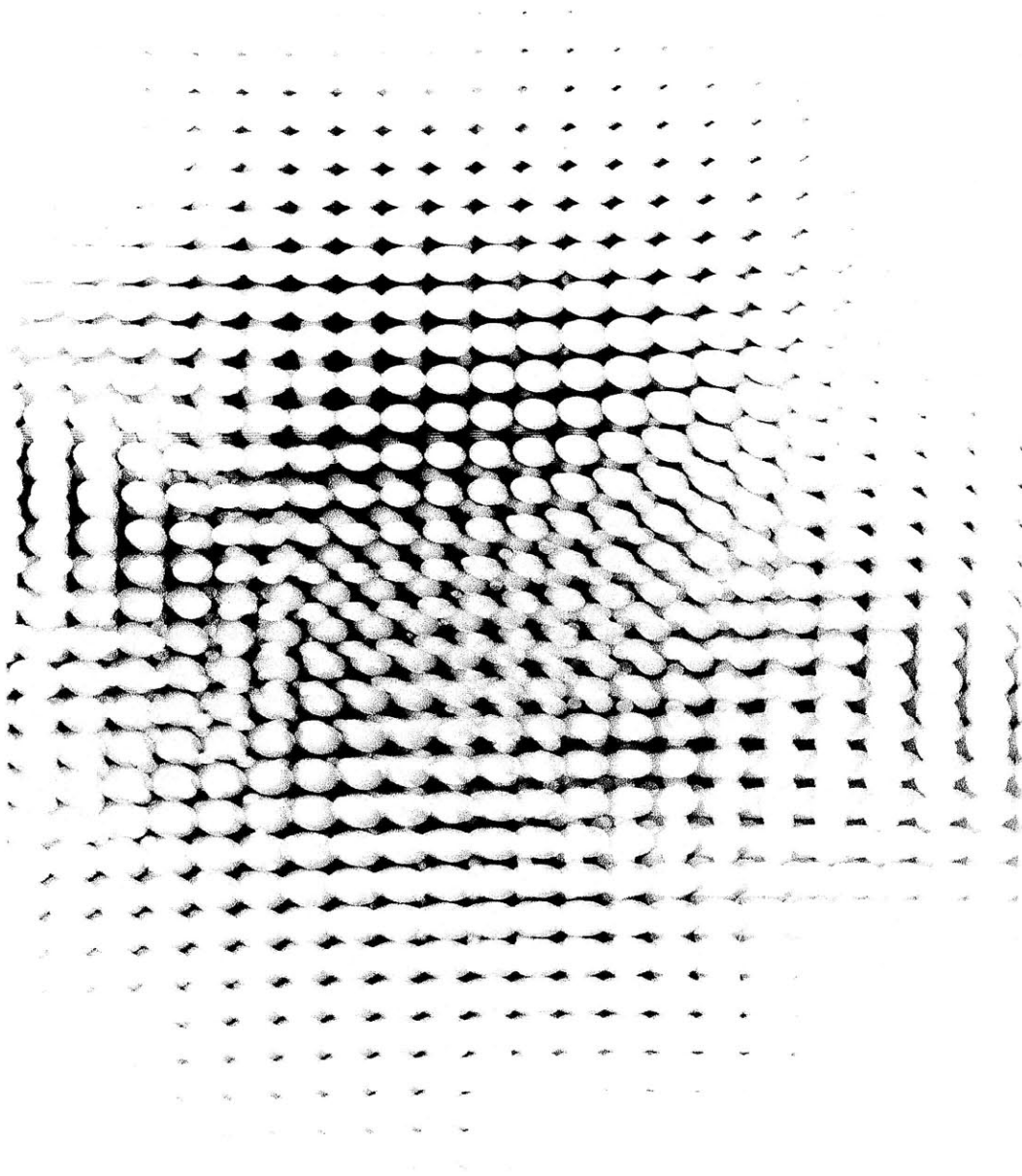
This study points out the rather obvious: Algorithms (geometry) and milieus (environment) are related through feedback. Growth is the result of a combination of the two.

The implications of pointing out this relationship are not quite that obvious and remain unresolved: What does this reciprocity mean for a discipline where growth is the equivalent to design?

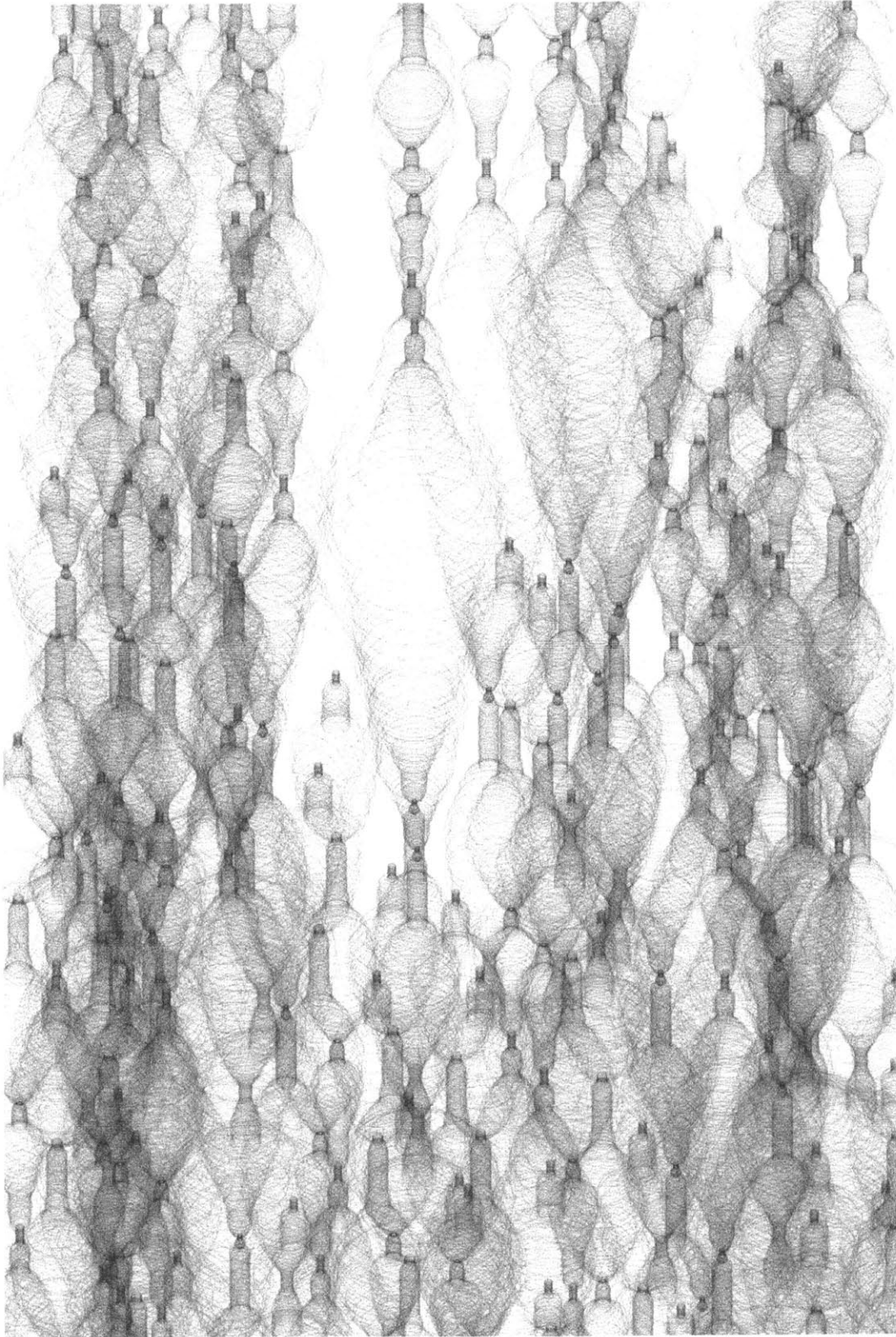
Anthroplasia explores the human condition based on the assumption that we are entering a new era in earth's geological history - the Anthropocene. This paradigm shift has major repercussions on the relationship between man-made and natural systems. In the Anthropocene past assumptions and ideologies have to be questioned radically: Principles of contamination (states of disorder) have long been replacing principles of natural preservation (seemingly ordered states) as the new primary vessels of meaning for the production of anthropocene environment, architecture, ecology, society and culture. In the Anthropocene, man enters cycles of colossal ephemerality: How do we react to the conditions we produce? Where, and: Why? The process is the playground of the anthropocene architect! Milieu and Algorithm unite!

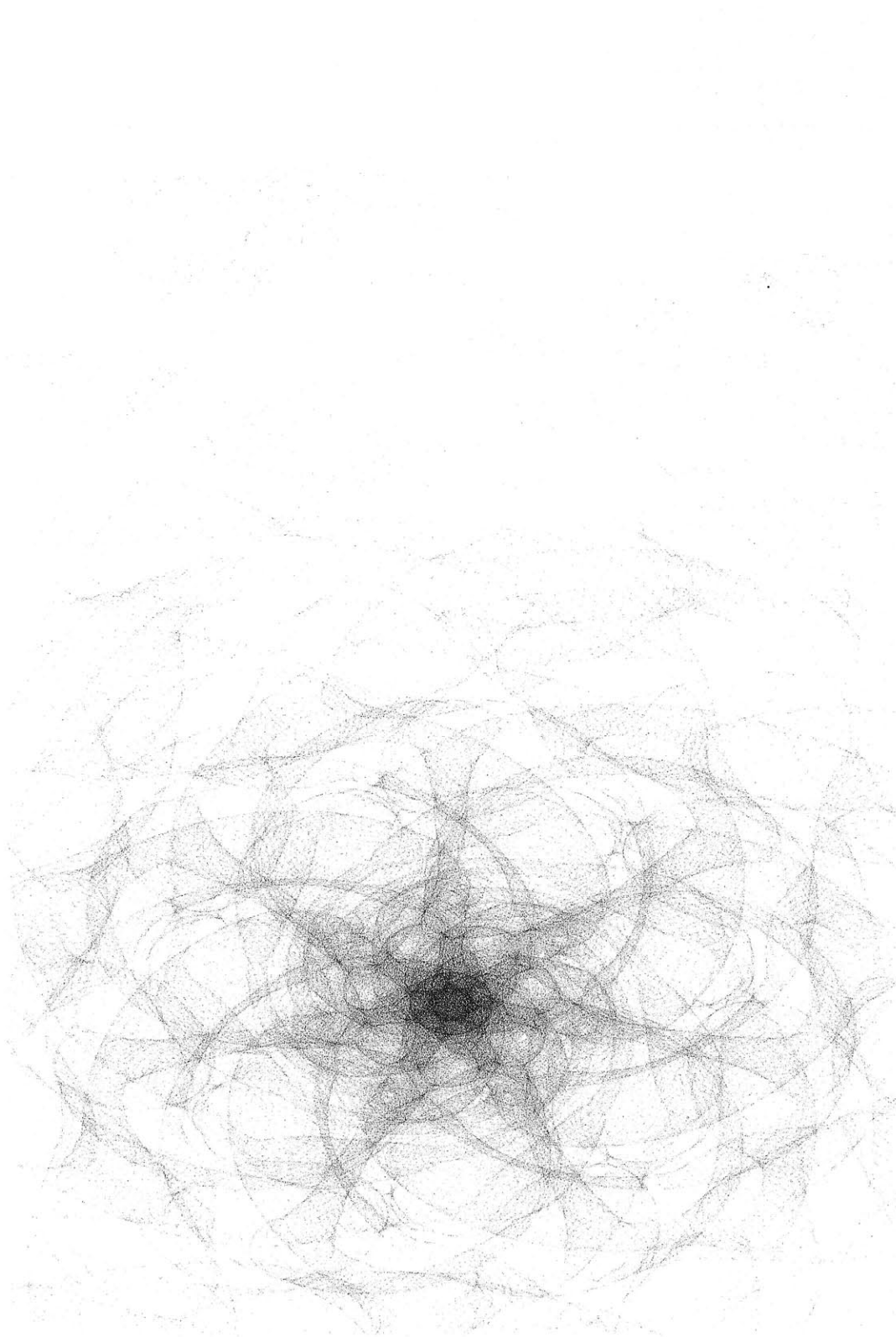


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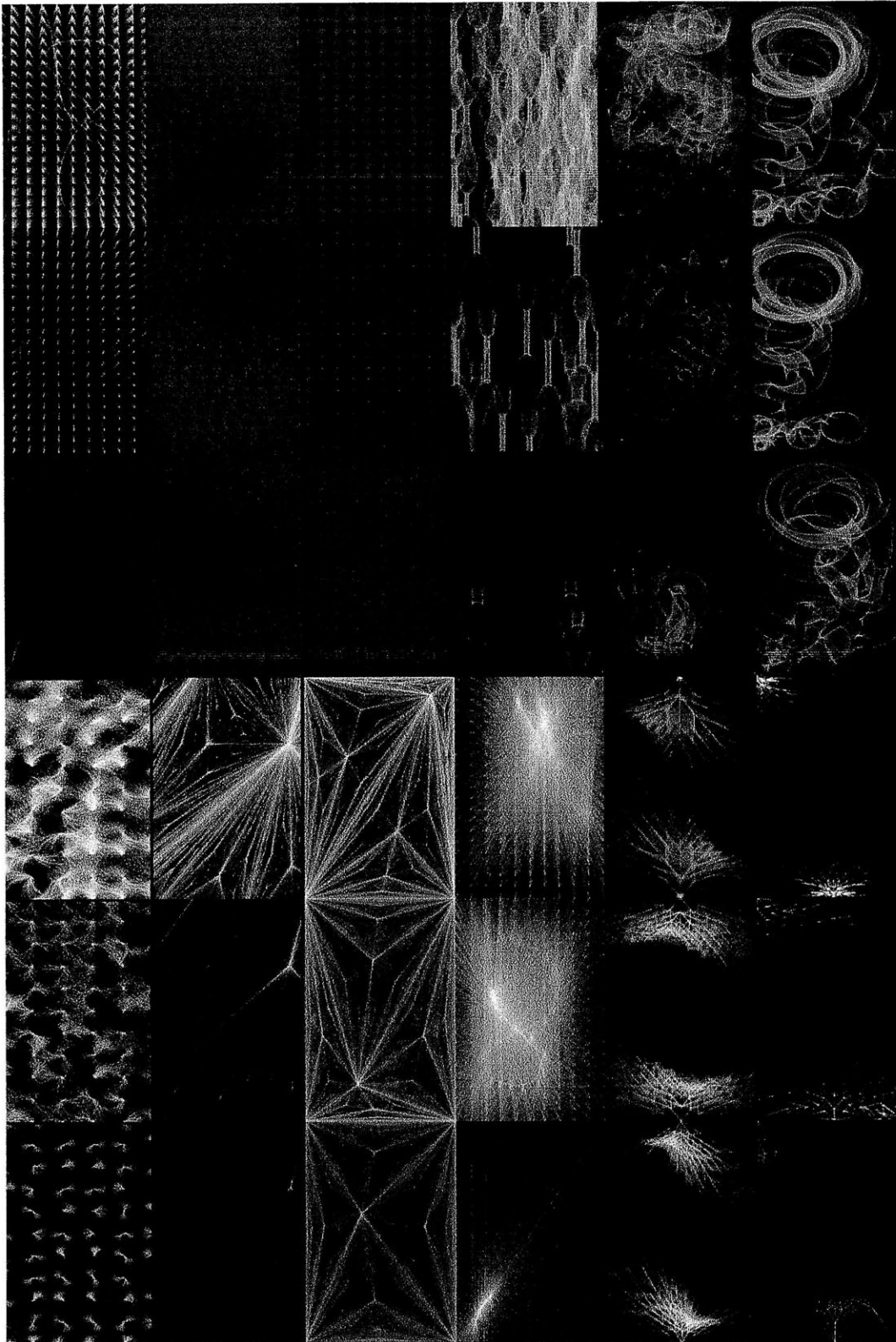




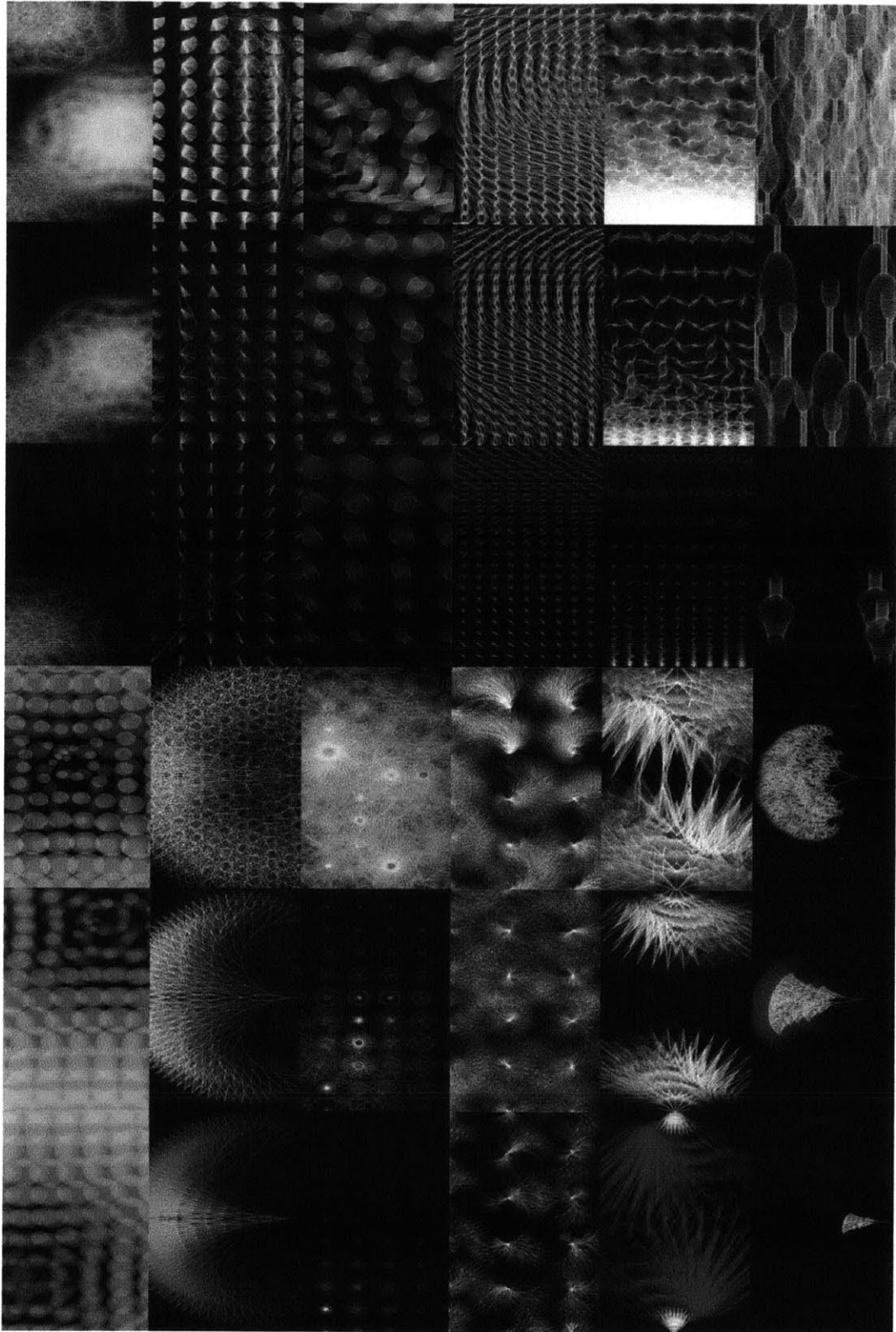
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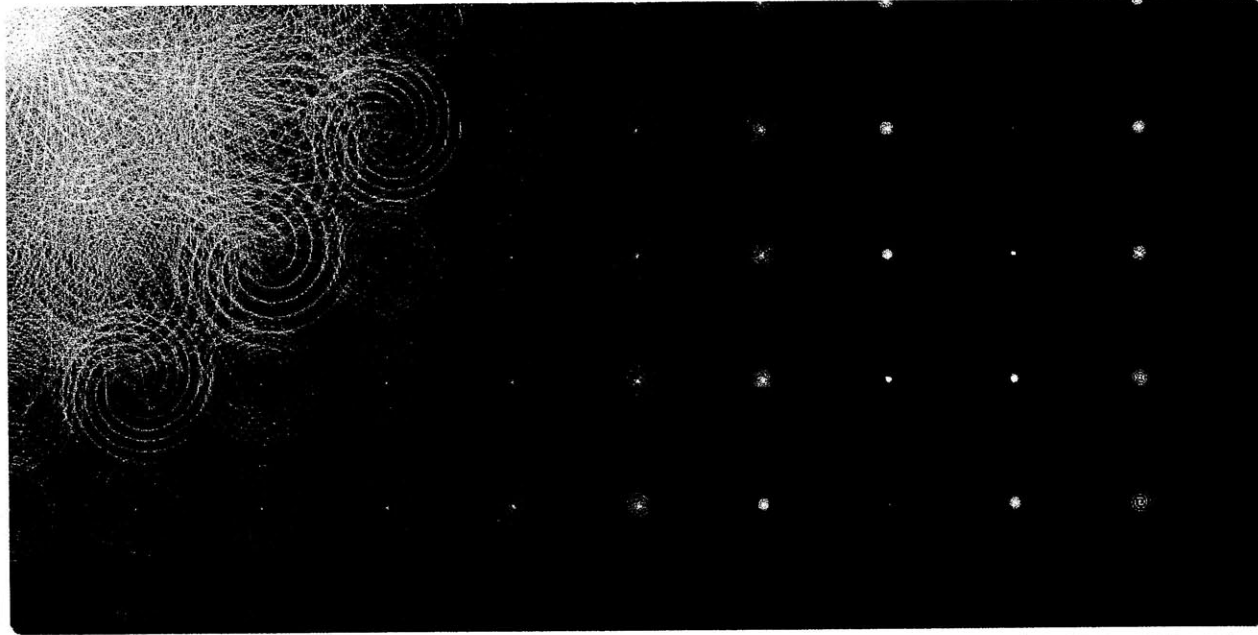




```
// Home
// phase 01 | testing processing
// phase 02 | field experimentations
// phase 03 | growth behavior

// 00 field index
// 04 fields spiral
// 01 field spiral
// 02 field spiral
// 03 field spiral
// 04 field spiral
// 05 field spiral
// 06 field spiral
// 07 field spiral
// 08 field spiral

<< back          reload sketch>>
```



Description

```
//////////////////////////////////////
04 fields spiral
//////////////////////////////////////
```

Within a spiral, parameters such as the overall radius or the angle between each step can be controlled via mouse input. Spirals expand at different speeds and may end up turning into hexagons, pentagons, stars, and other regular polygonal geometries.

A field of spirals creates different overlapping zones of lines, adding a new, more complex layer of information to the field. The changing speed of growth within the field creates light zones with very little activity and areas with high density expansive patterns.

```
//////////////////////////////////////
Phase 02 | field experimentations
//////////////////////////////////////
```

Fields are most fascinating when they change, transform, move, morph

Processing Source Code

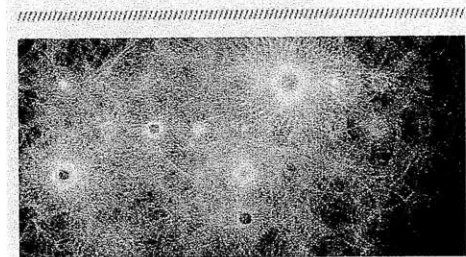
```
//////////////////////////////////////
// Written by Sasa Zivkovic
// No.mad discourse | www.nomaddiscourse.com
// No.mad process | www.nomadprocess.com
//////////////////////////////////////
int framewidth = 15;
int num = 2000;
int spacing = 100;

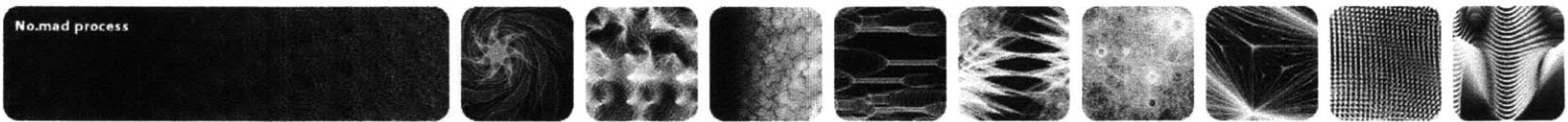
//////////////////////////////////////
////// declare and create array
My_Spiral[] spiralObj = new My_Spiral[num][num];

float a;
float b;
float eaz;

//////////////////////////////////////
```

Images

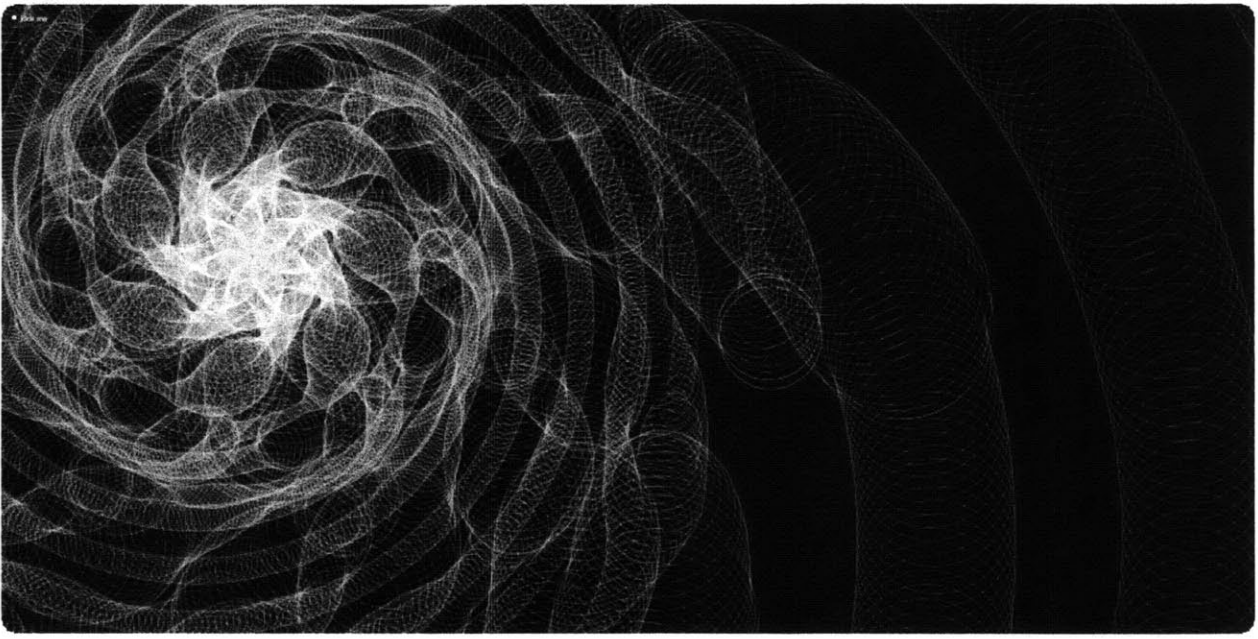




```
// Home
// phase 01 | testing processing
// phase 02 | field experimentations
// phase 03 | growth behavior

// 00 testing index
// 03 growing things
// 01 growing things
// 02 growing things
// 03 growing things
// 04 growing things

<< back          reload sketch >>
```



Description

```
////////////////////////////////////
03 growing things

"Growing things" reveals the exciting power of Processing. A couple fairly
simple lines of code generate an infinite amount of possible forms, shapes
and objects. Seen as a progression in time and a layering of information,
the drawing becomes a potential compass to understand the relationship
between a geometric object and the milieu it was produced by.

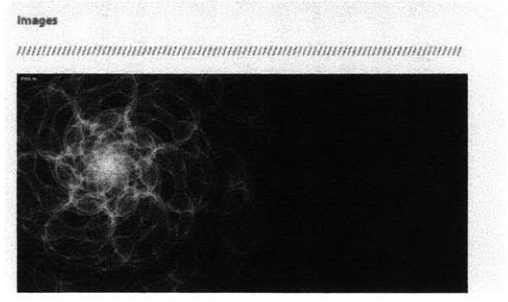
////////////////////////////////////
phase 01 | testing processing

The first phase of this project is an attempt to test and understand how
Processing works. Testing Processing' is based on examples from 'Getting
Started with Processing' written by Casey Reas and Ben Fry. The book
introduces parametric design tools such as conditionals, variables, for
```

Processing Source Code

```
////////////////////////////////////
// Written by Sasa Zivkovic
// No.mad discourse | www.nomaddiscourse.com
// No.mad process | www.nomadprocess.com
// Inspired by example 7-15 (Spirals) from "Getting started with Processing"
////////////////////////////////////
float angle = 0.0;
float offset = 200;
float scalar = 2;
float speed1 = 0.9;
float speed2 = 0.02;
float diameter = 2;

////////////////////////////////////
void setup() {
size(1000, 500);
frameRate(150);
```

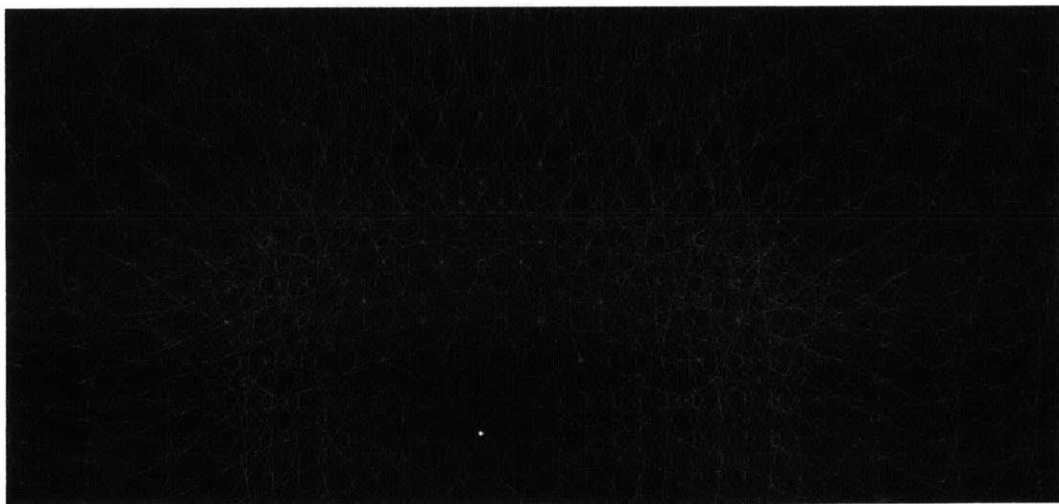
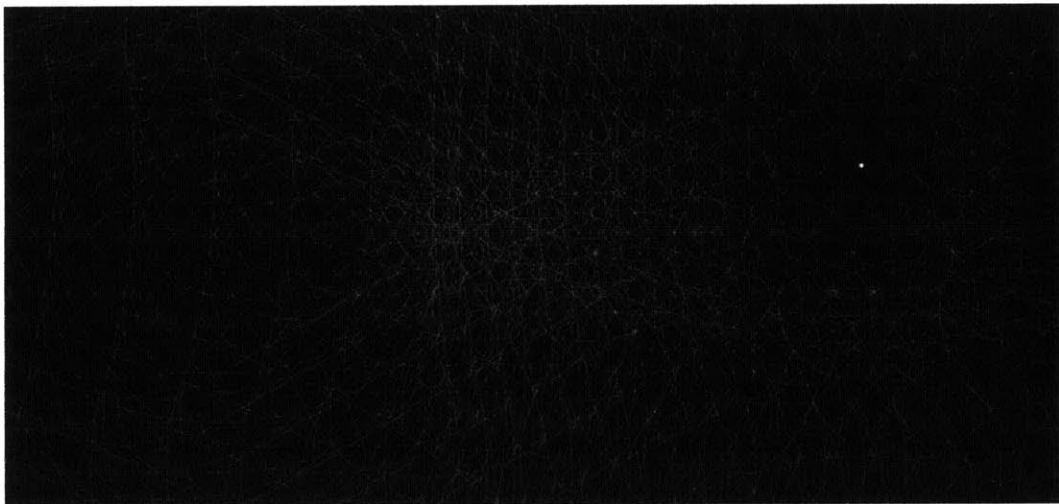
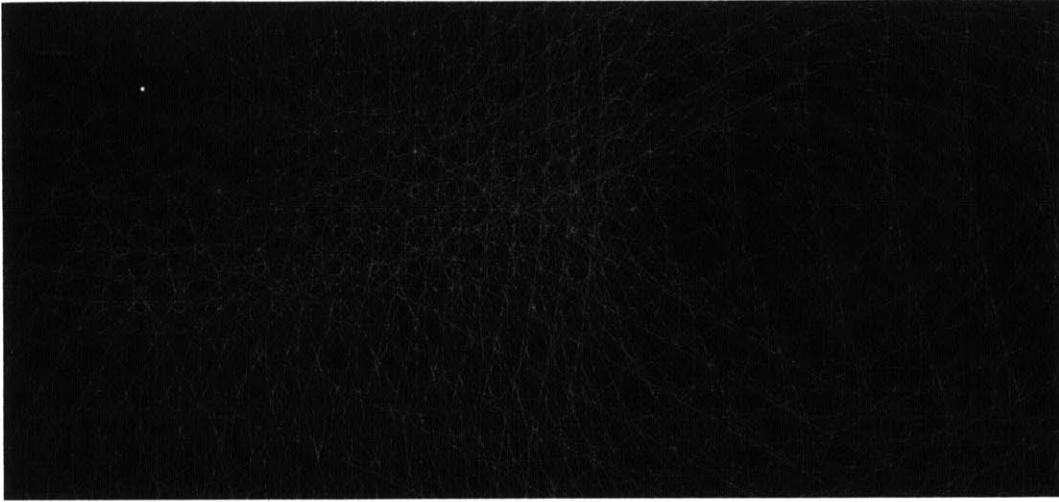


Milieus and Algorithms

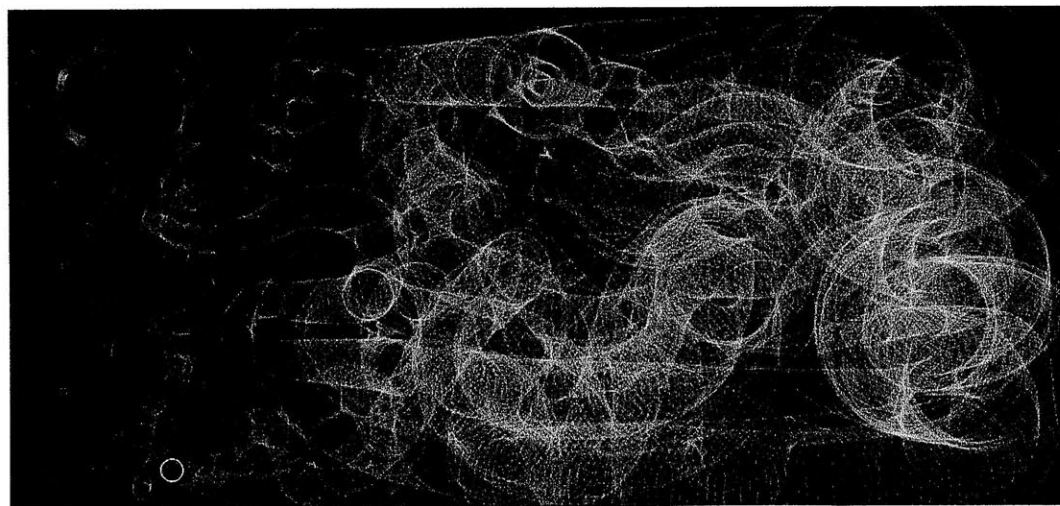
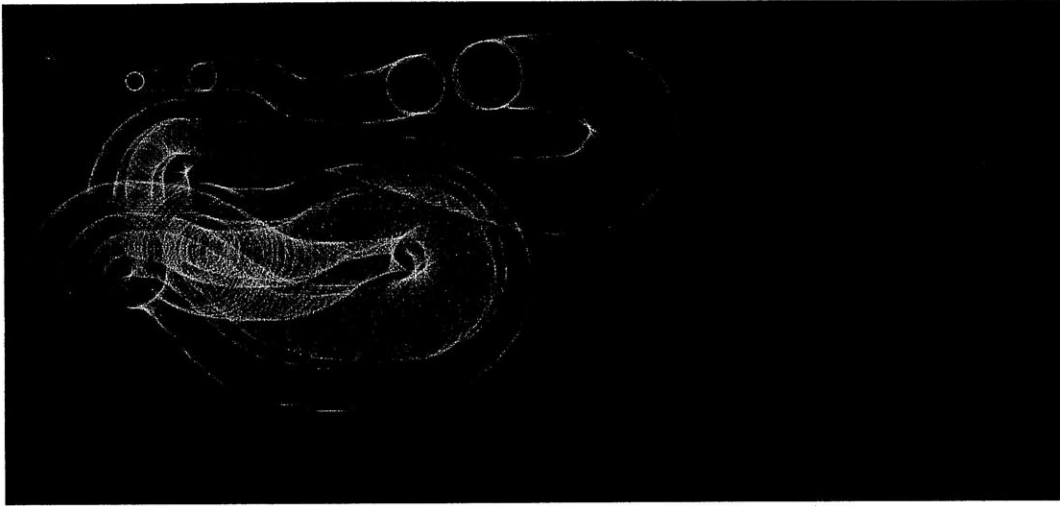
Phase 01: testing processing

The first phase of this project is an attempt to test and understand how Processing works. 'Testing Processing' is based on examples from 'Getting Started with Processing' written by Casey Reas and Ben Fry. The book introduces parametric design tools such as conditionals, variables, for loops, functions, objects and arrays. The ability to redraw an algorithm on top of it's last iteration is one of the most fascinating characteristics of processing. In addition, Processing allows for a number of 'environmental parameters' (mouse position, keyboard, etc) to interact with the algorithm while it redraws itself.

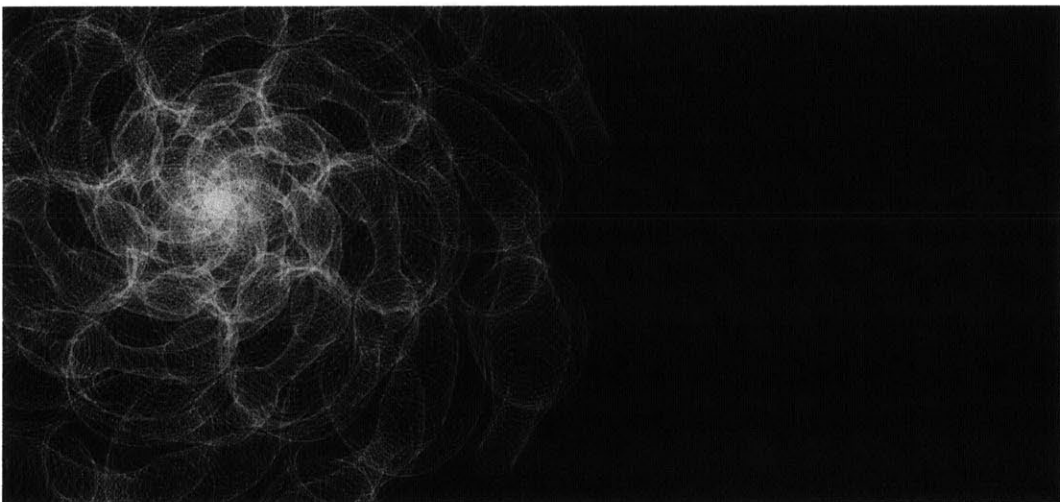
Processing opens up the possibility for an in depth exploration of growing systems and how they relate to the milieu which produces them. A good example of how a milieu influences growth can be studied in snowflakes: no snowflakes are alike, because the sequence of exterior conditions which influence the growth of the ice crystals are never the same.



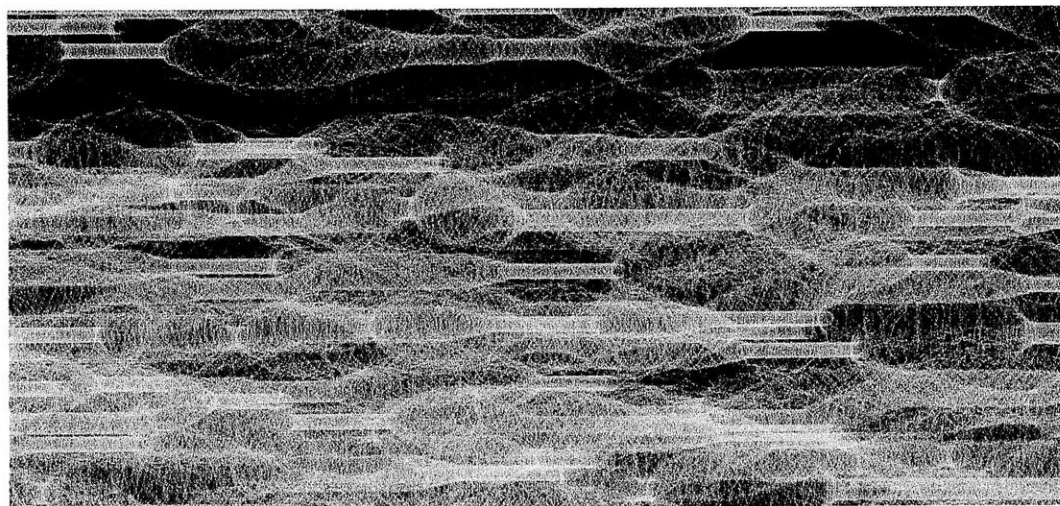
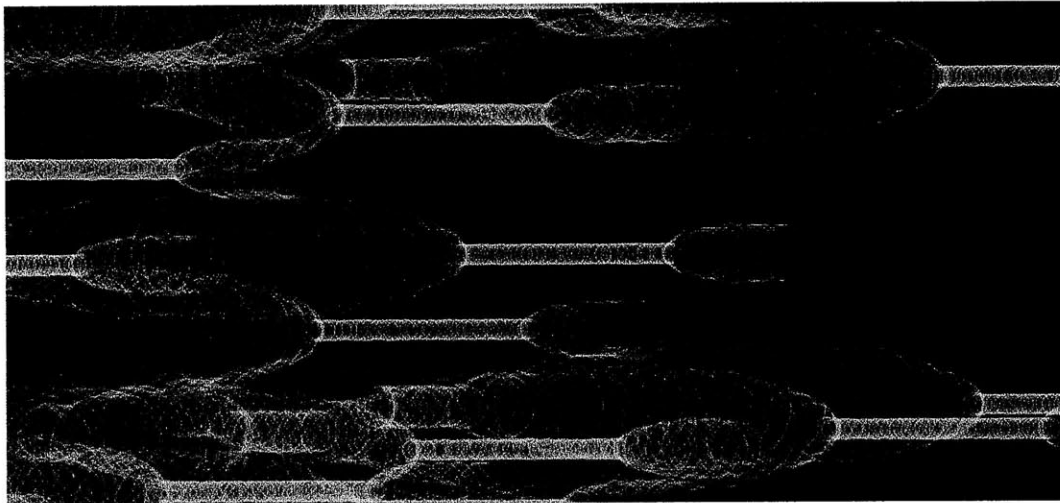
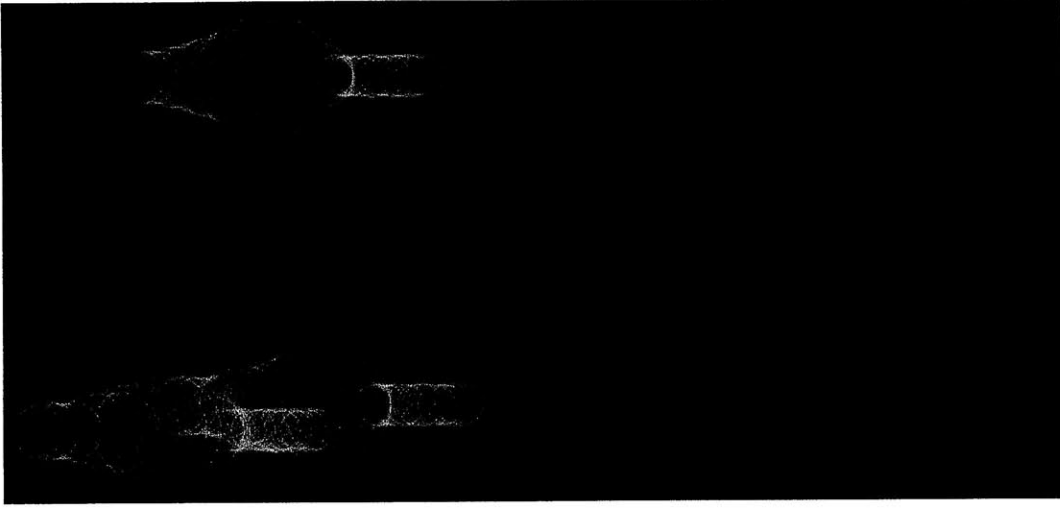
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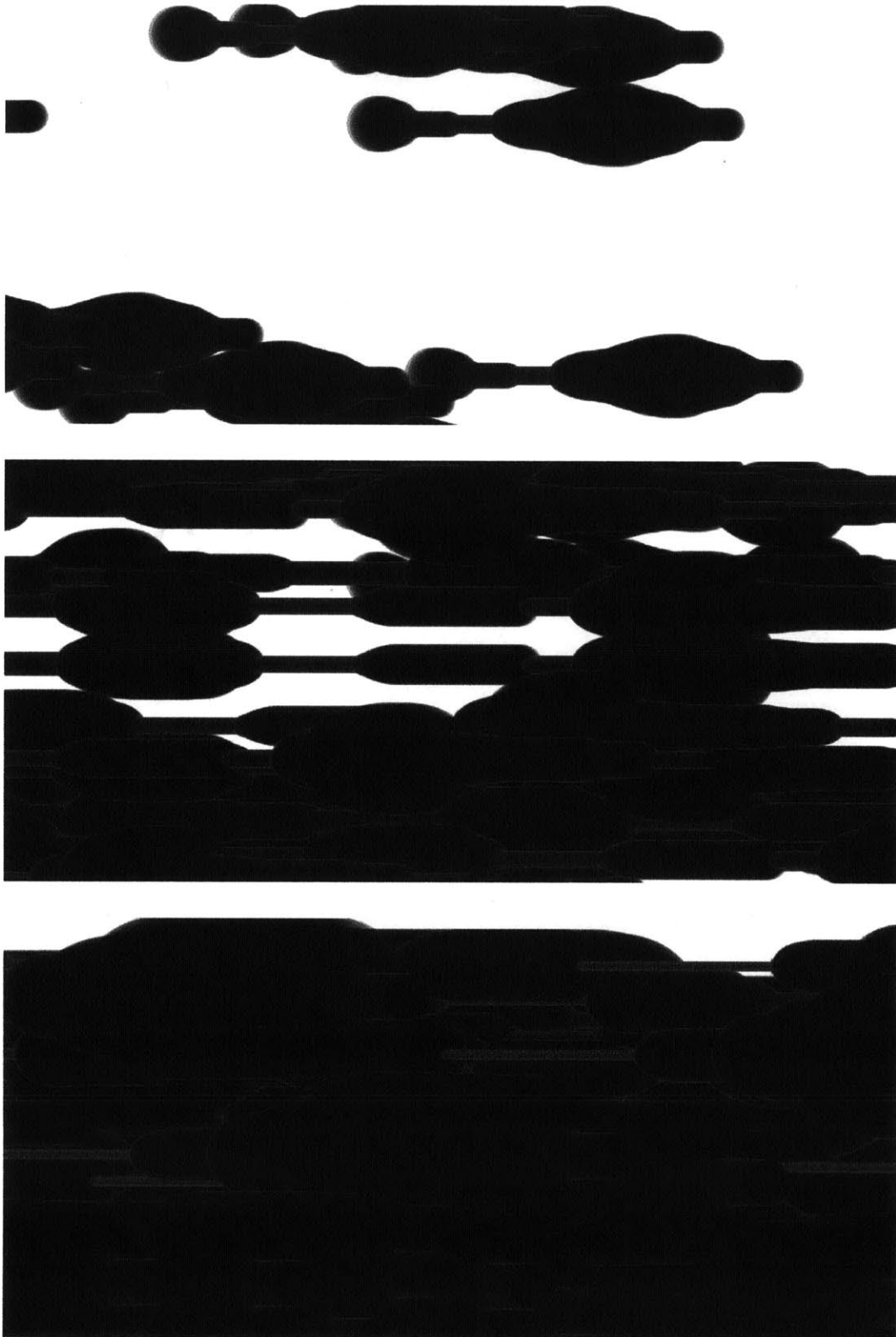
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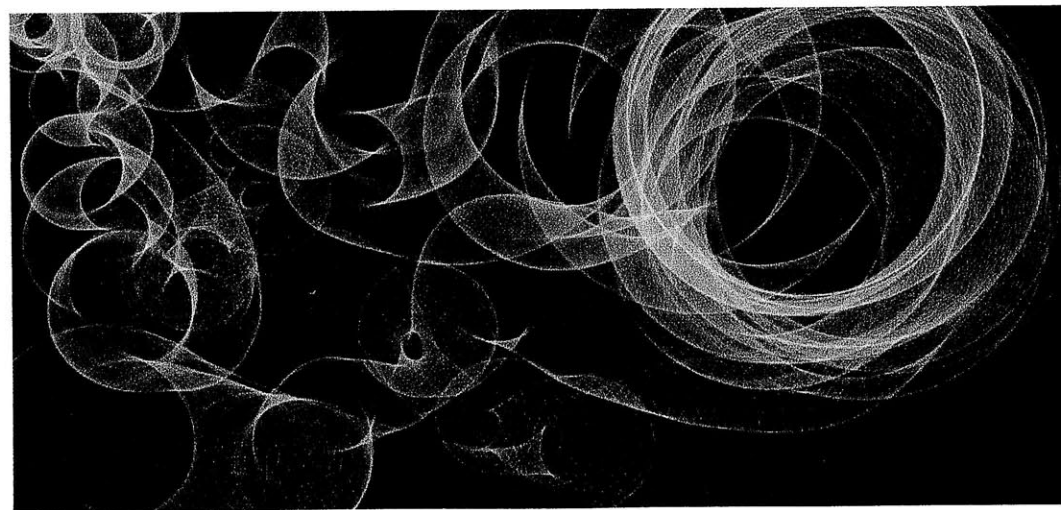
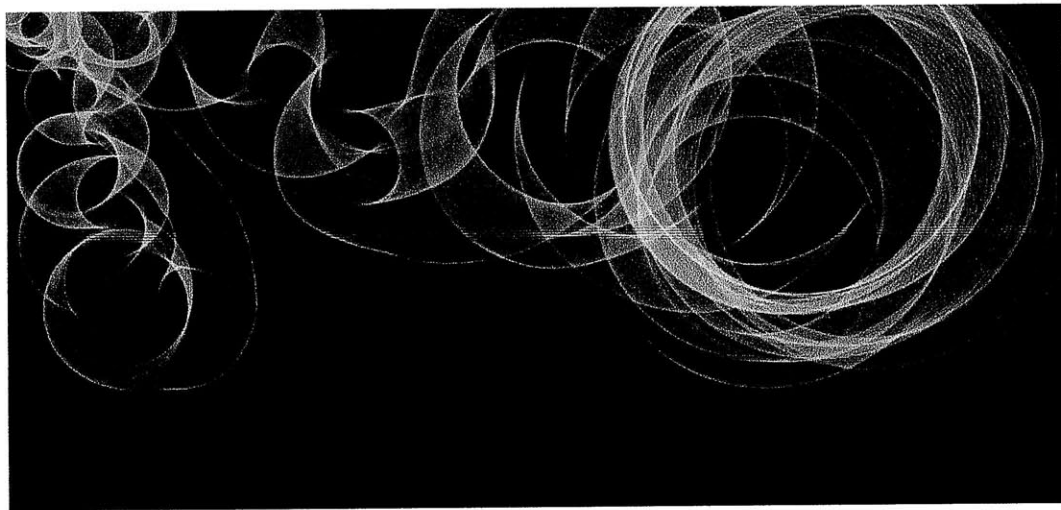
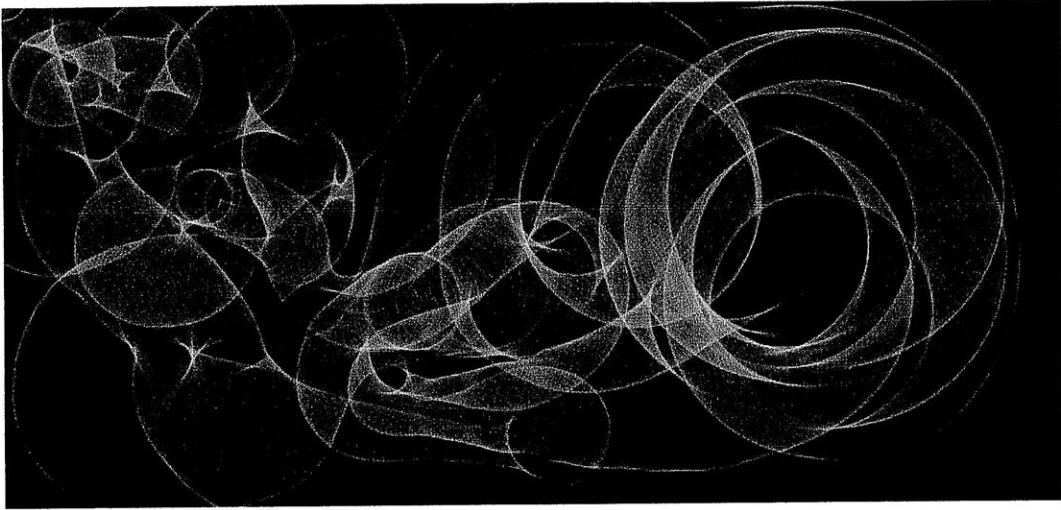
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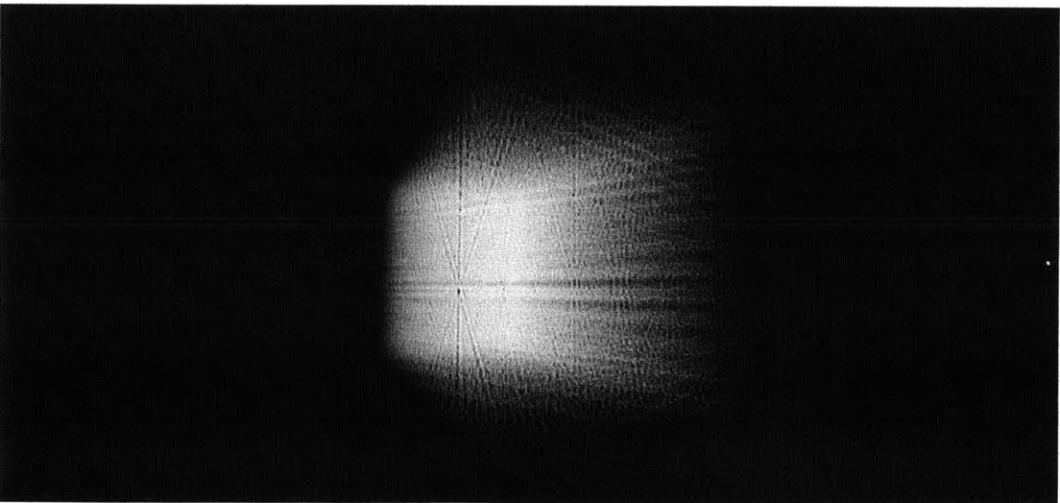
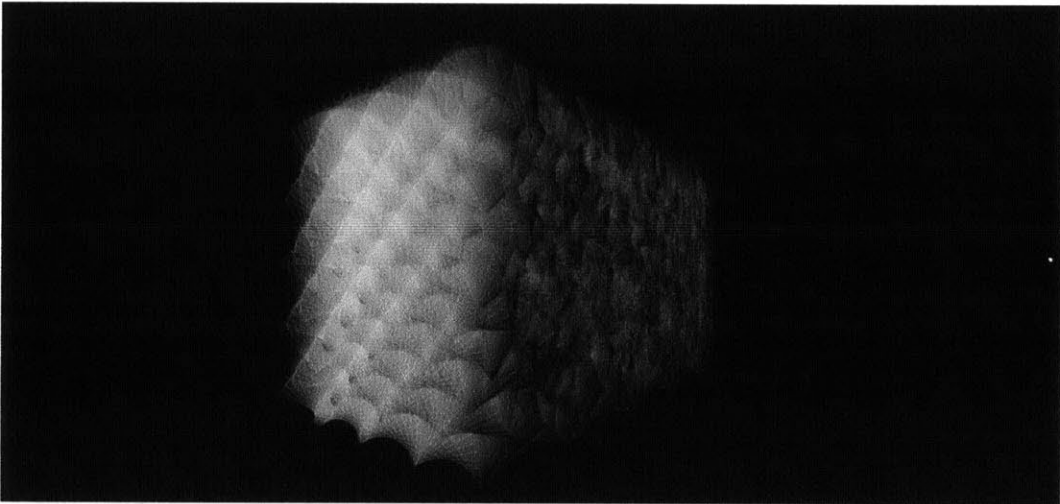
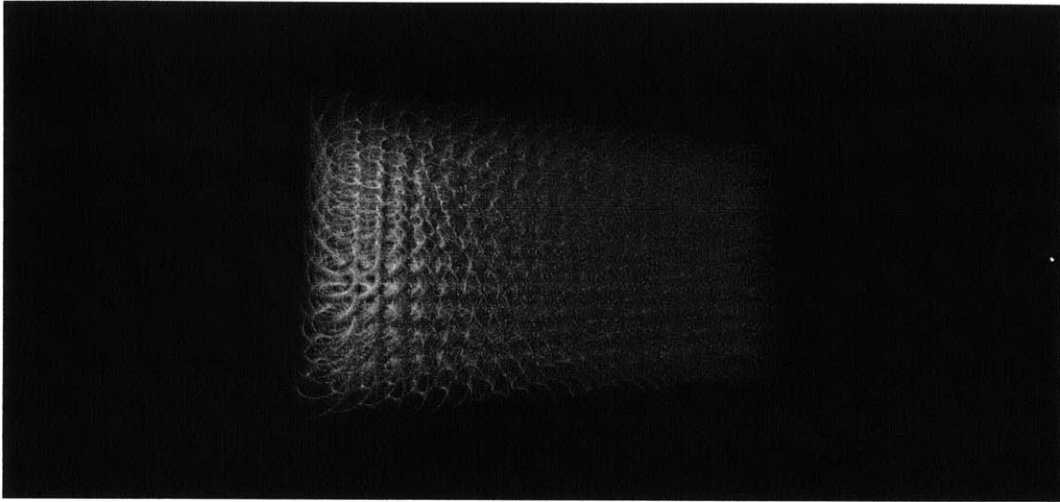
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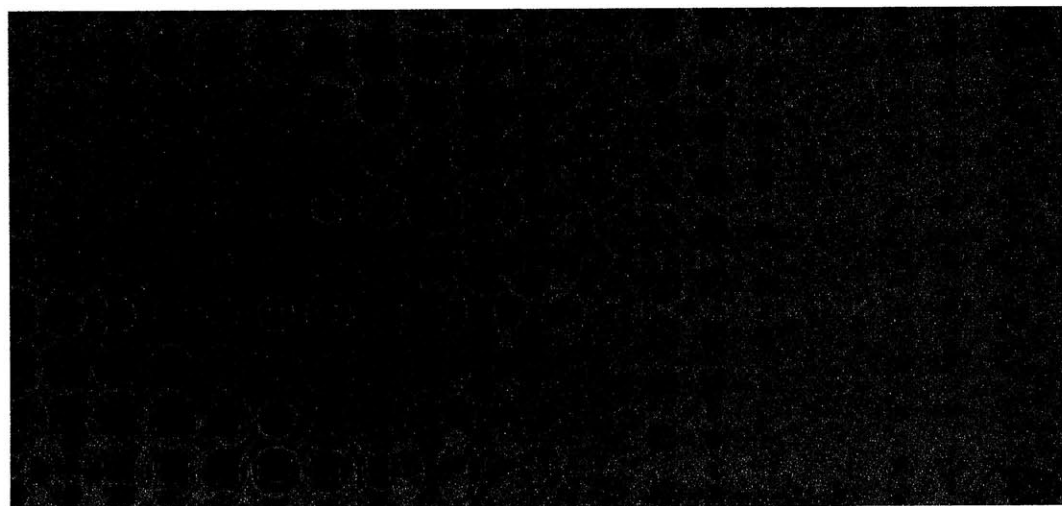
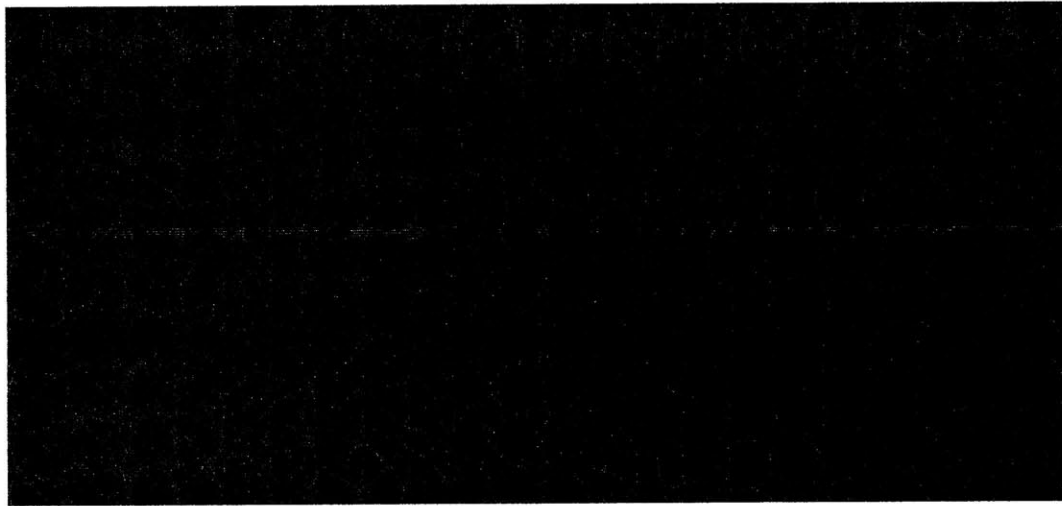
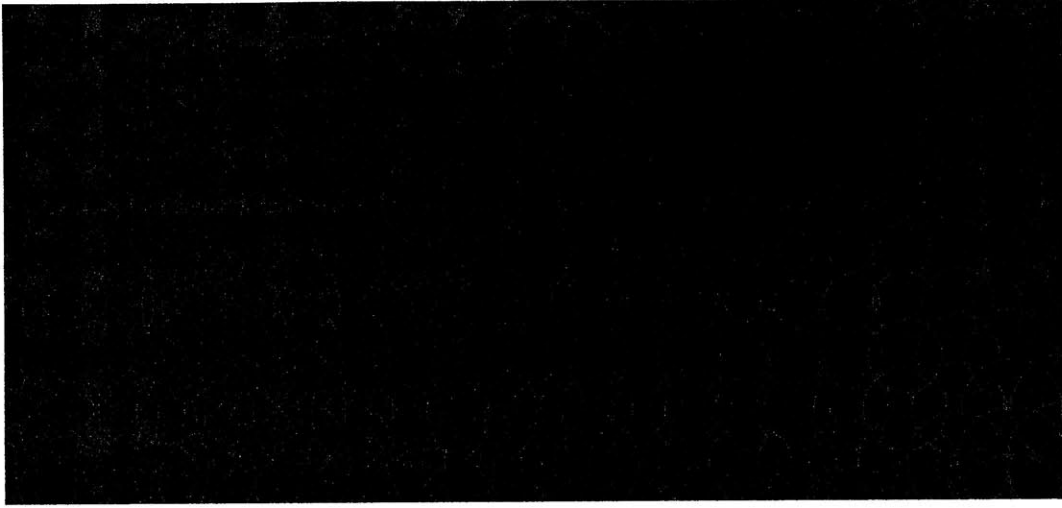


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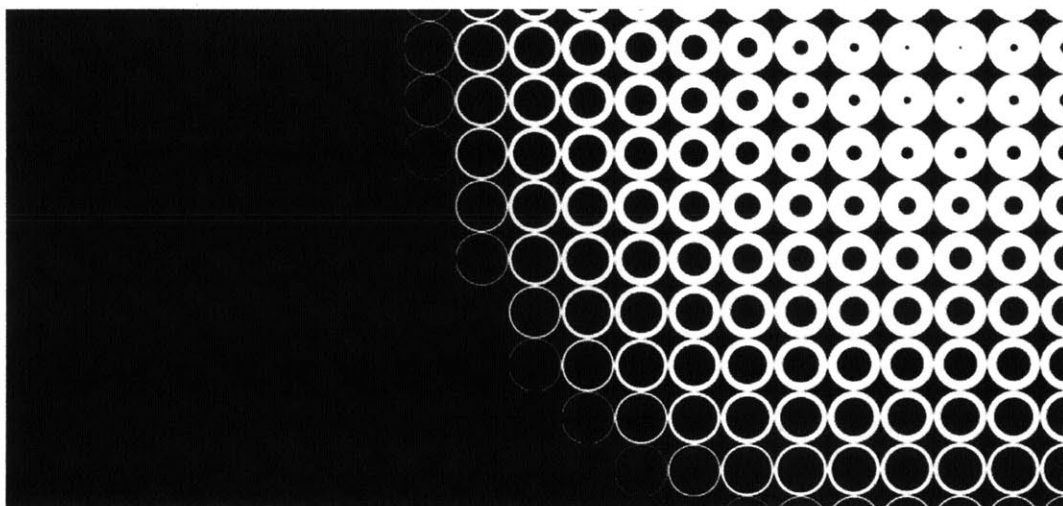
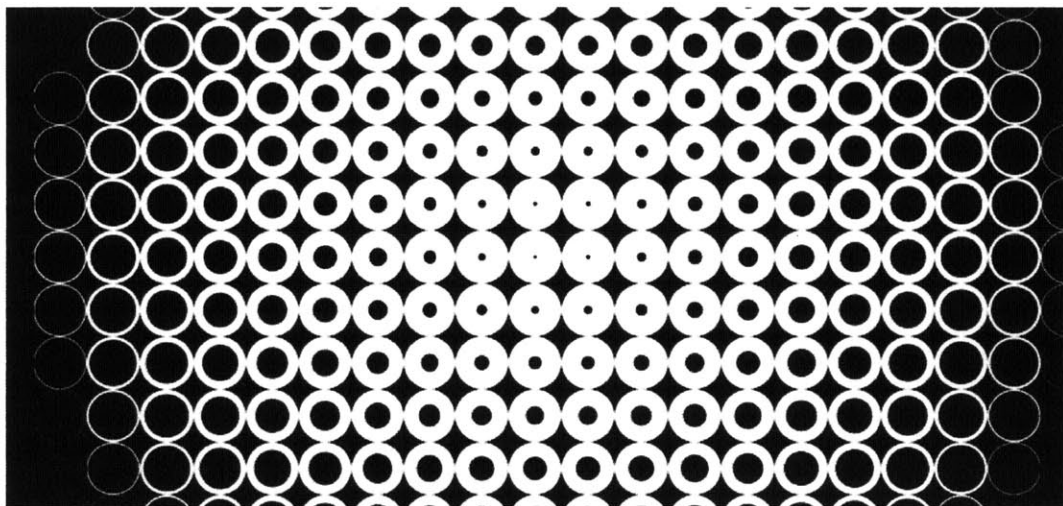
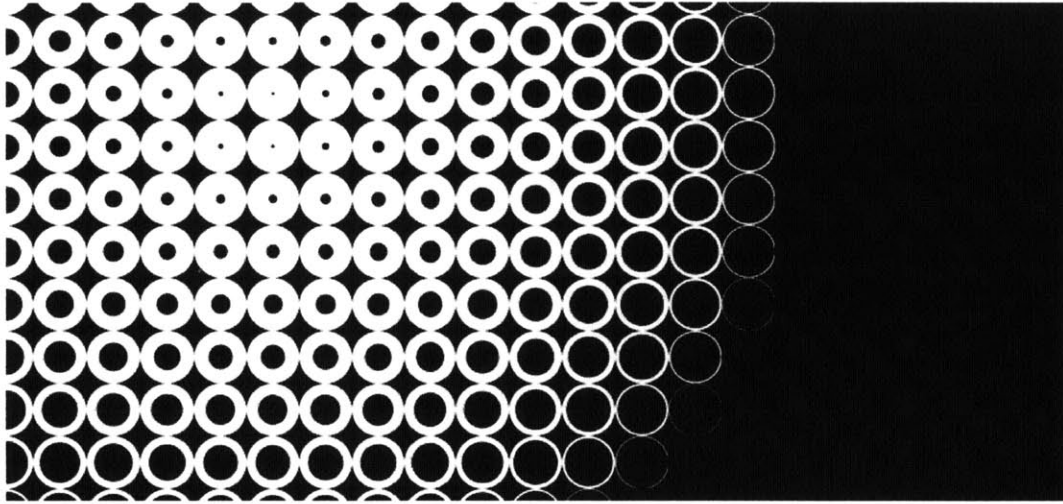


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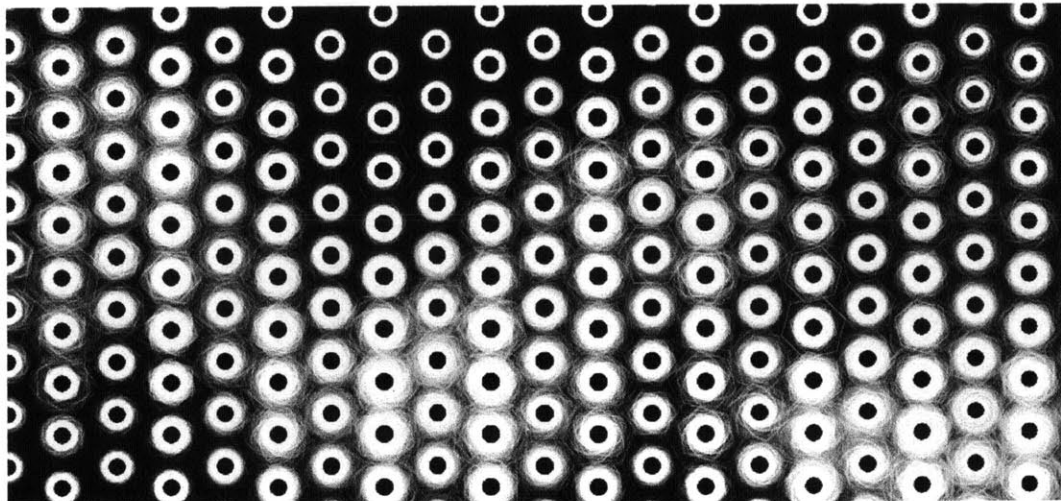
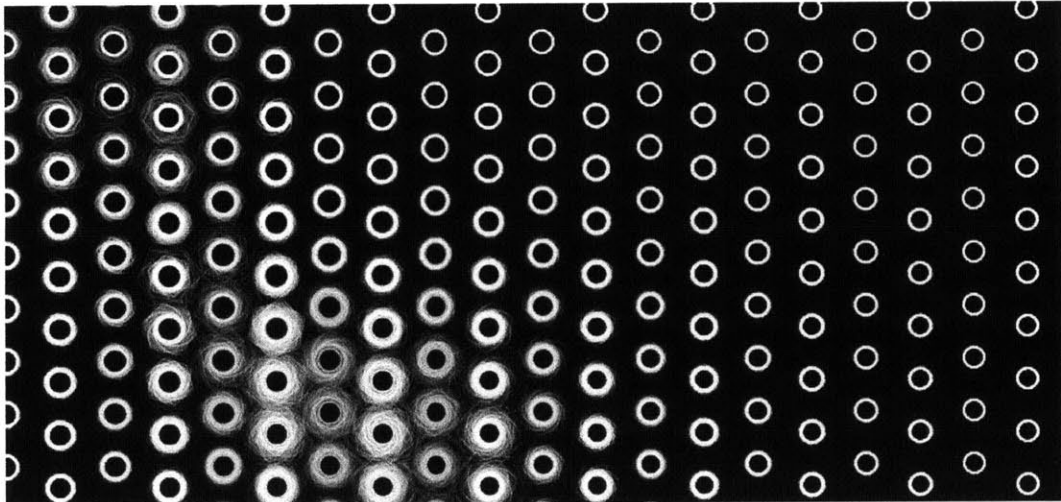
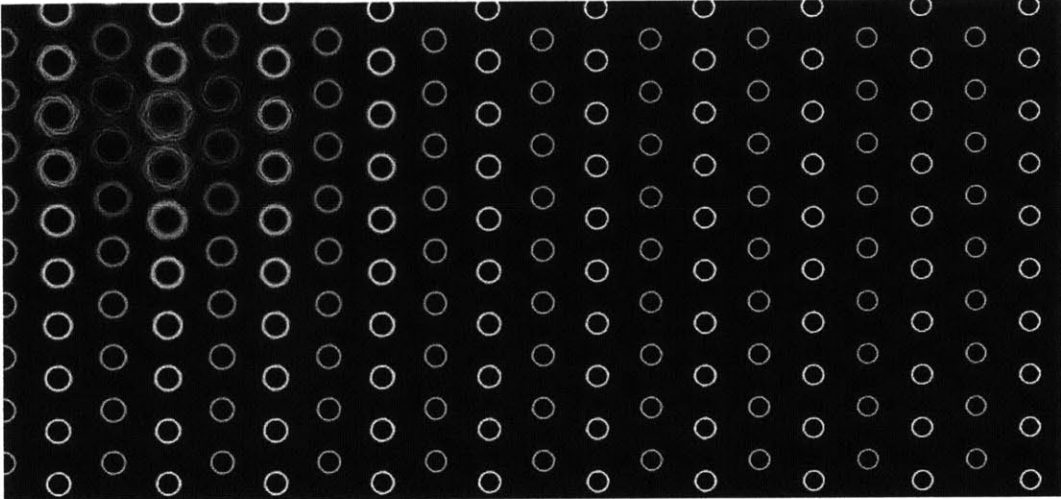
Phase 02: field experimentations

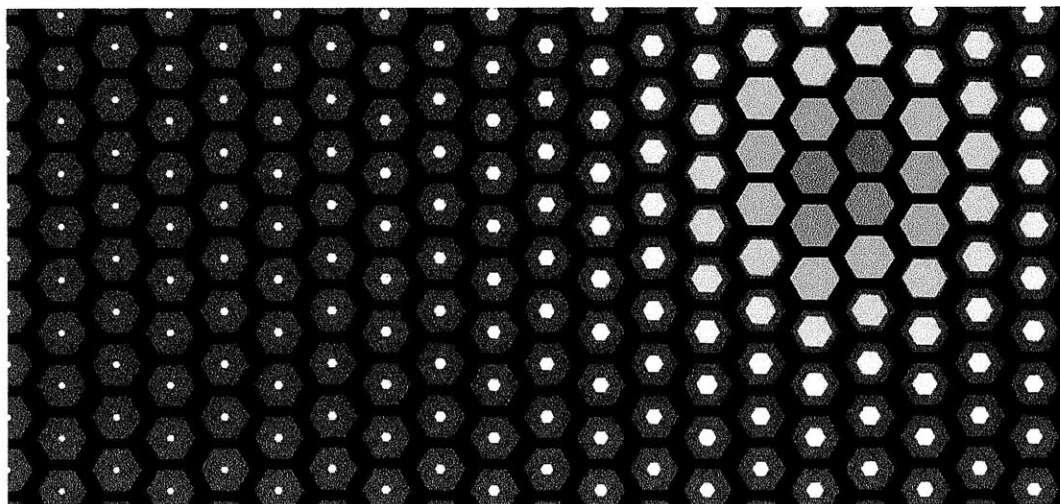
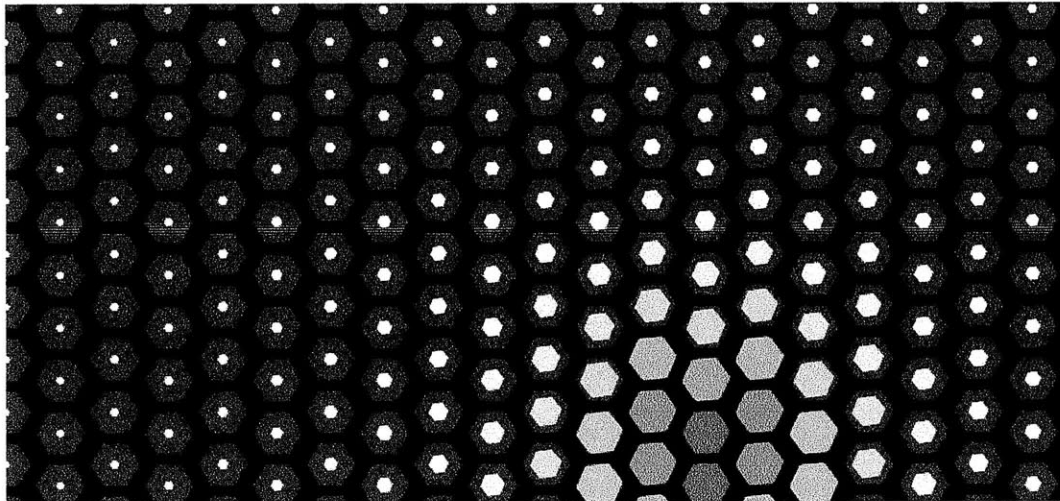
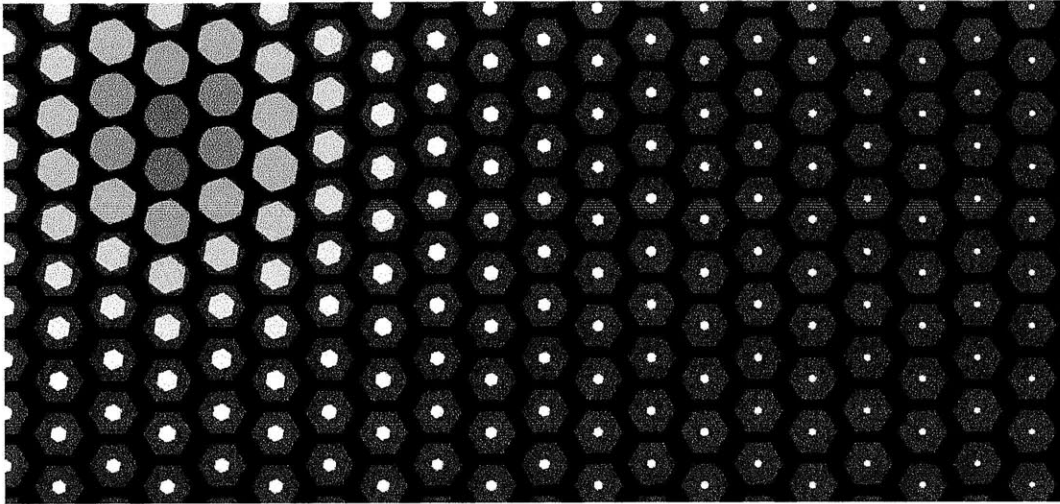
Fields are most fascinating when they change, transform, move, morph, adjust and recalibrate. Combining the ambiguous qualities of fields with 'evolutionary mutations' and the logic of growth reveals new possibilities for exploring new part-to-whole relationships within fields.

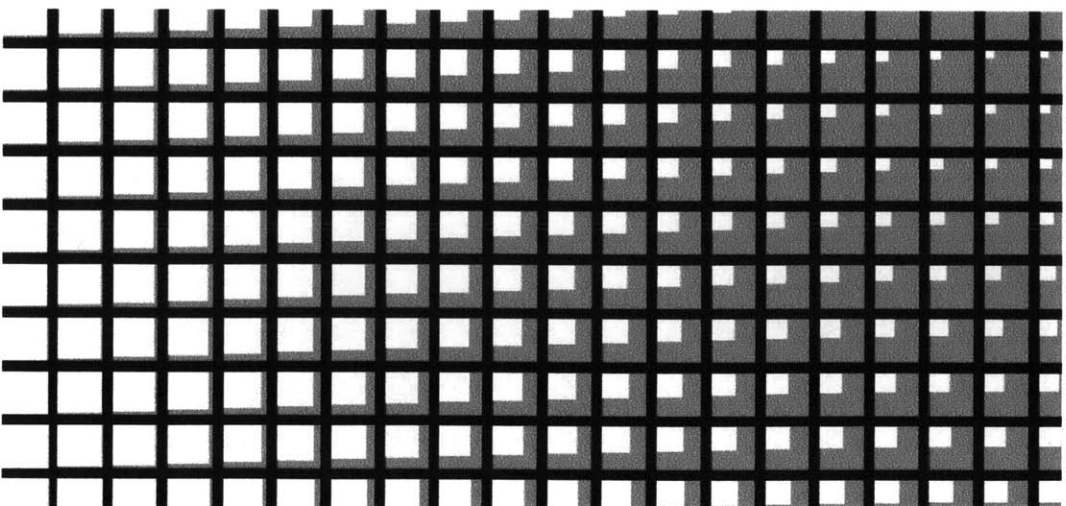
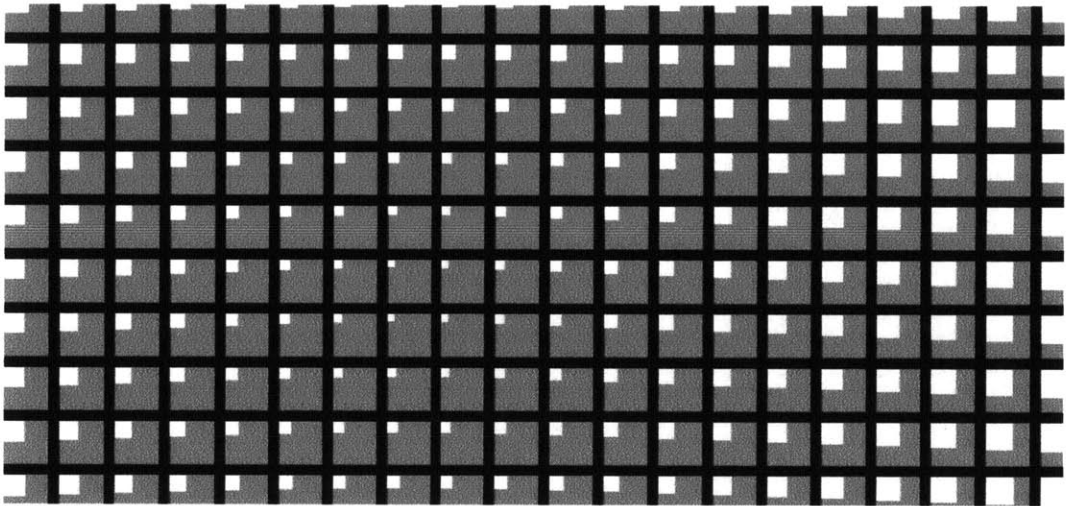
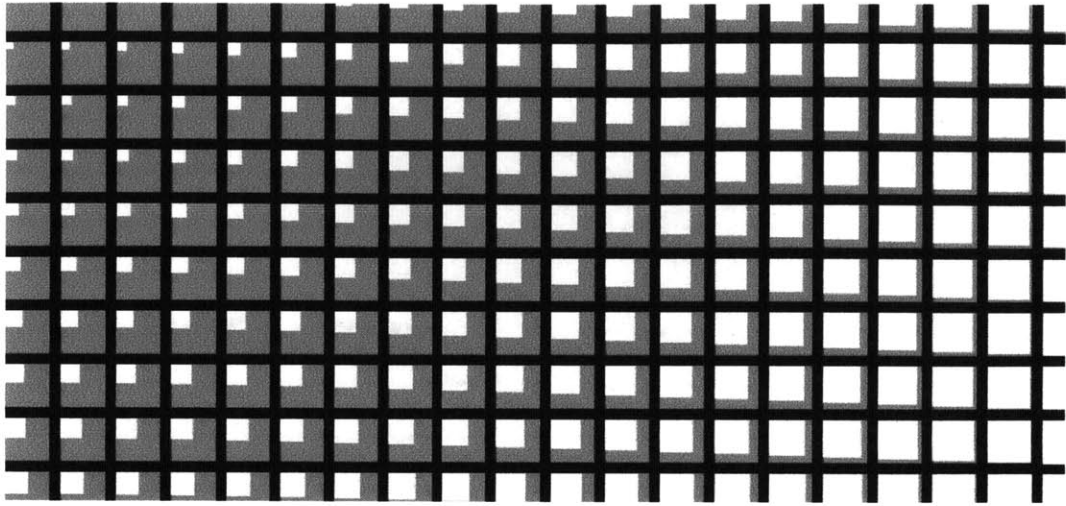
Processing stores the parameters of the milieu that created the object which it is currently drawing within the object itself (in relation to their geometric principles defined in the algorithm). Within one object alone, the effects of this relationship between milieu and geometry results in incredibly complex drawings of growing systems, but within multiple objects in fields, the effects multiply. 'Field experimentations' studies the complexity of growing fields and their ever changing part-to-whole relationships.

Within growing fields, each element itself is as complex as a snowflake. Together, the elements form a new type of augmented field, raising the question if a reevaluation of the relationship between geometry and milieu is possible – and, in the long run, what effects this would have on architecture and its current obsession with temporality, environment and even ecology.

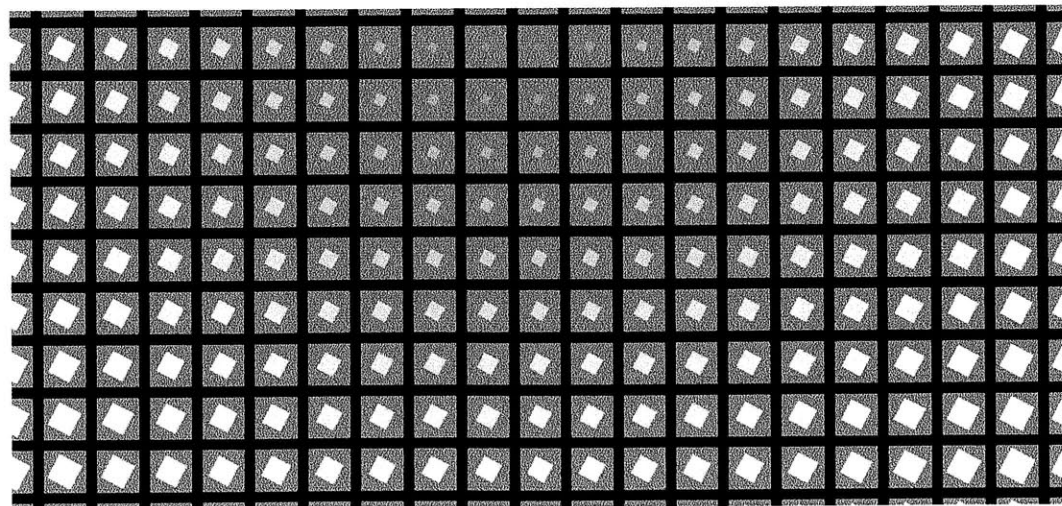
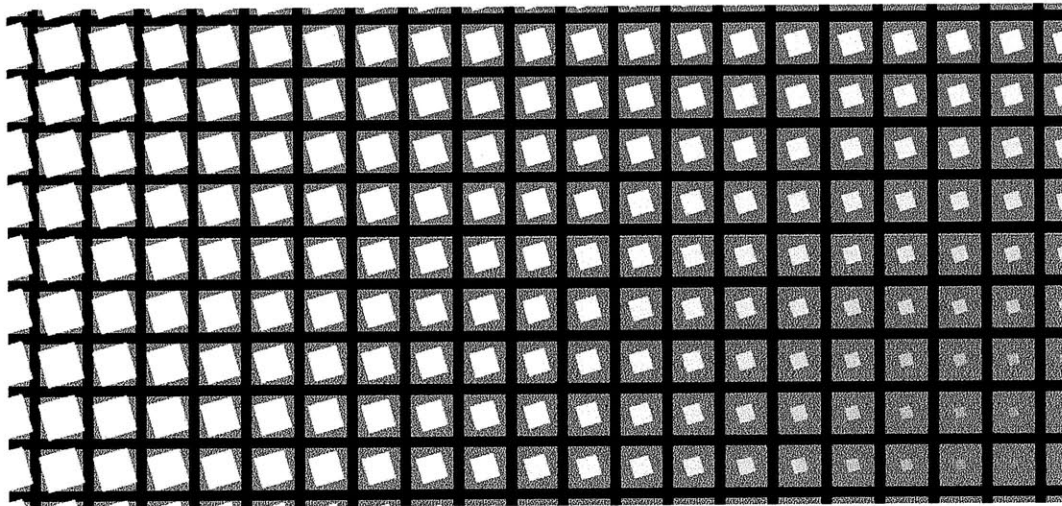
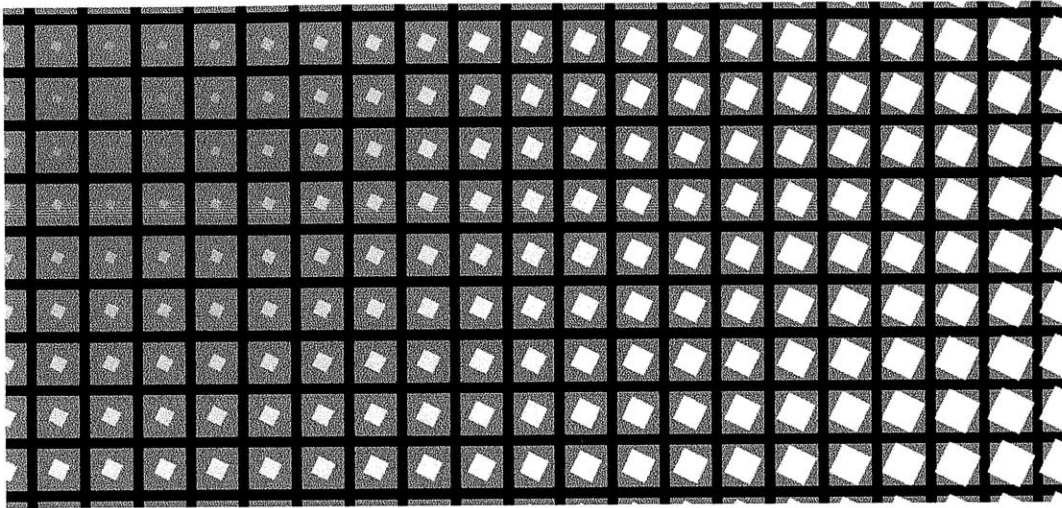
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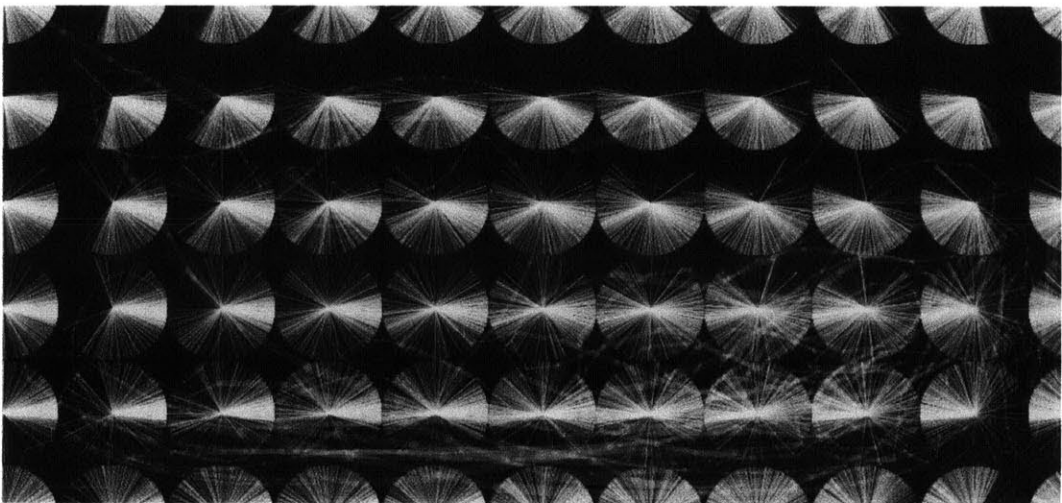
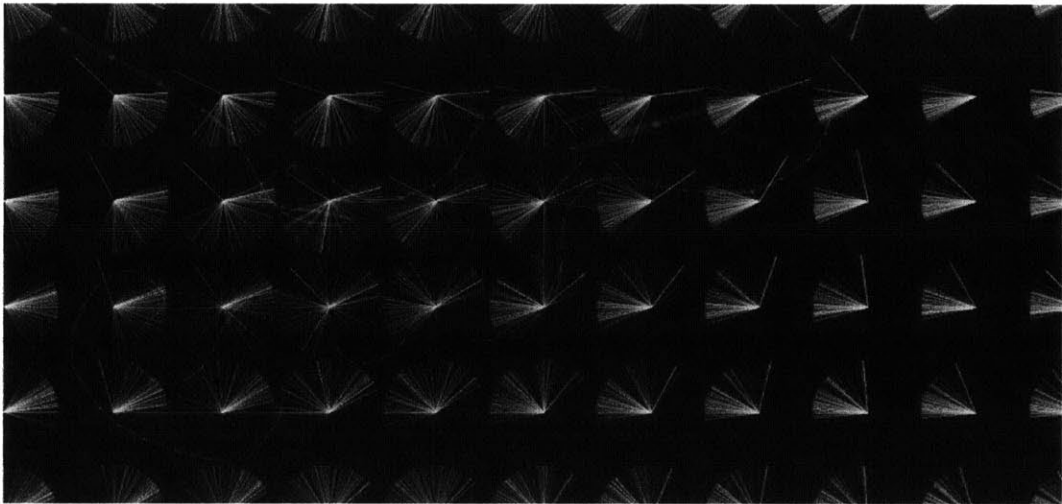
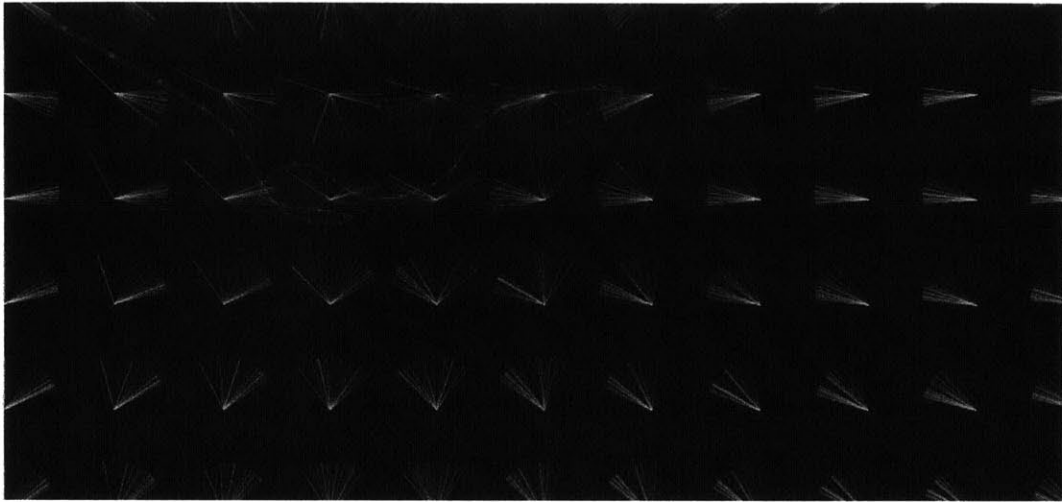




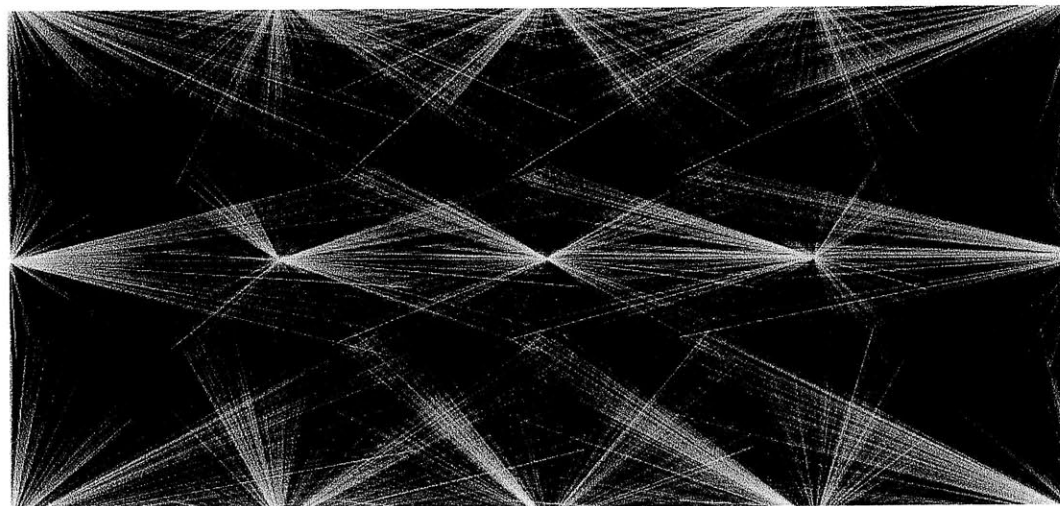
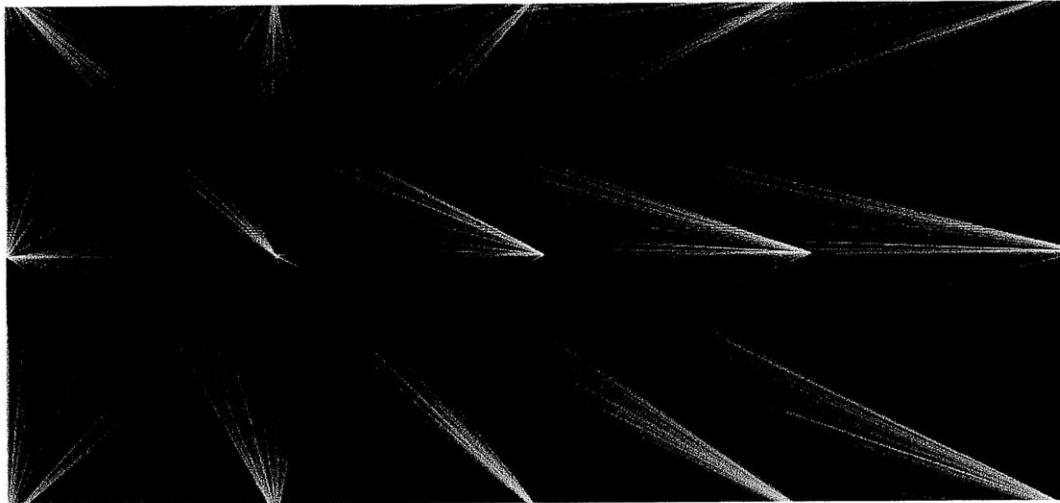
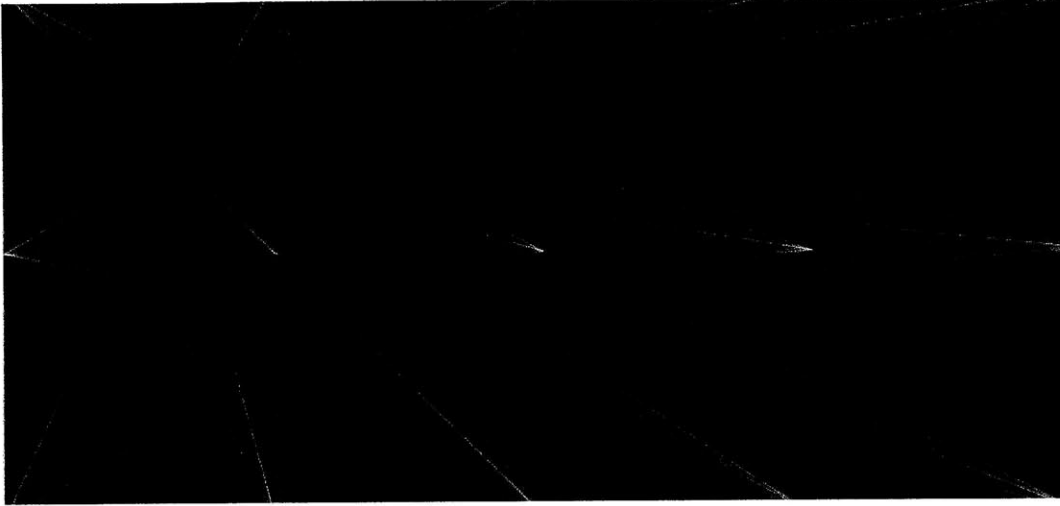
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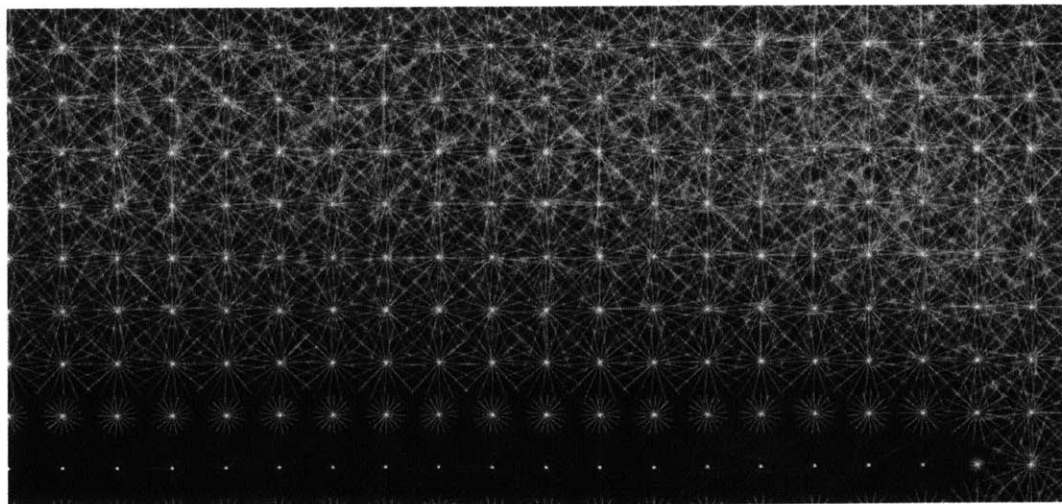
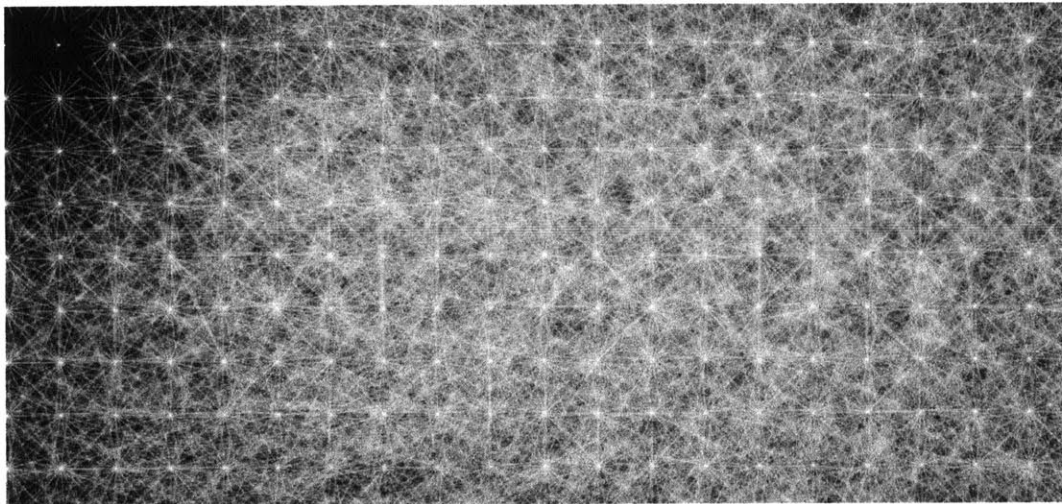
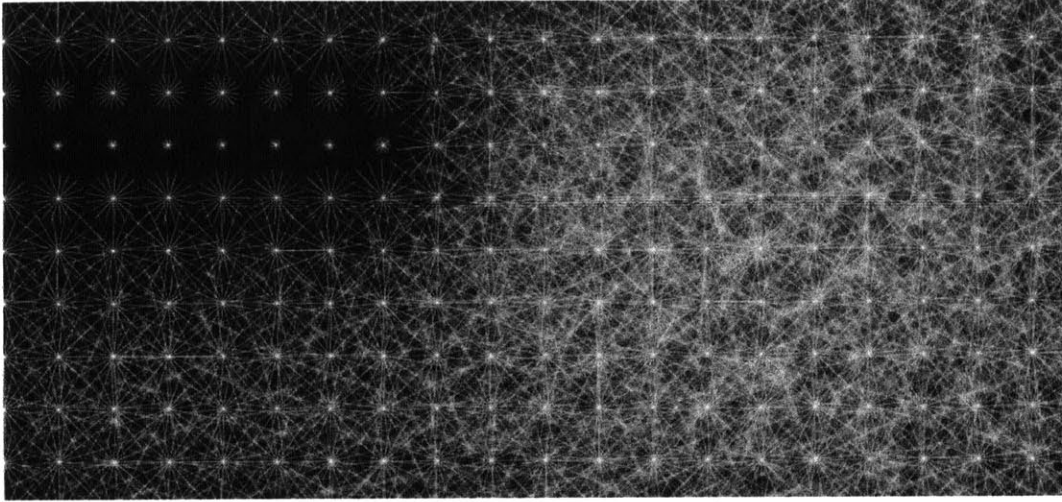
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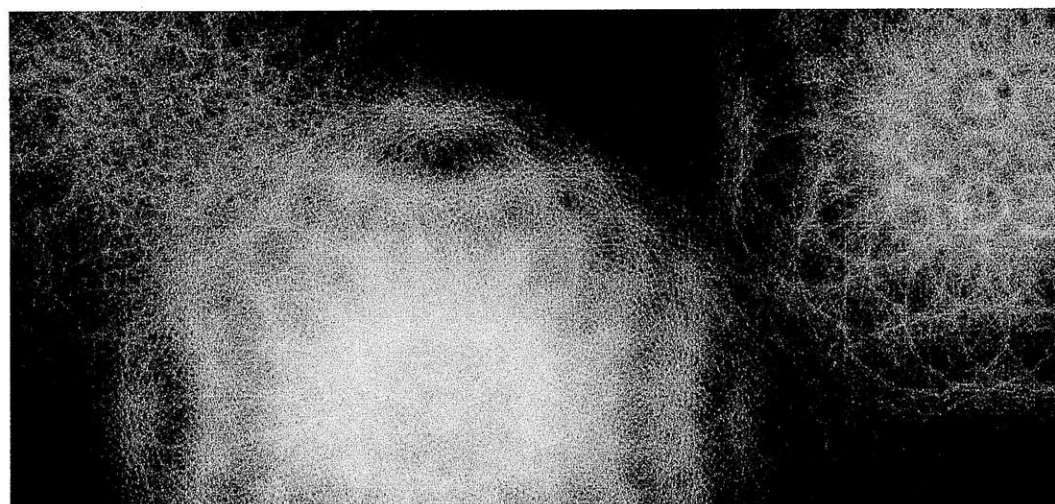
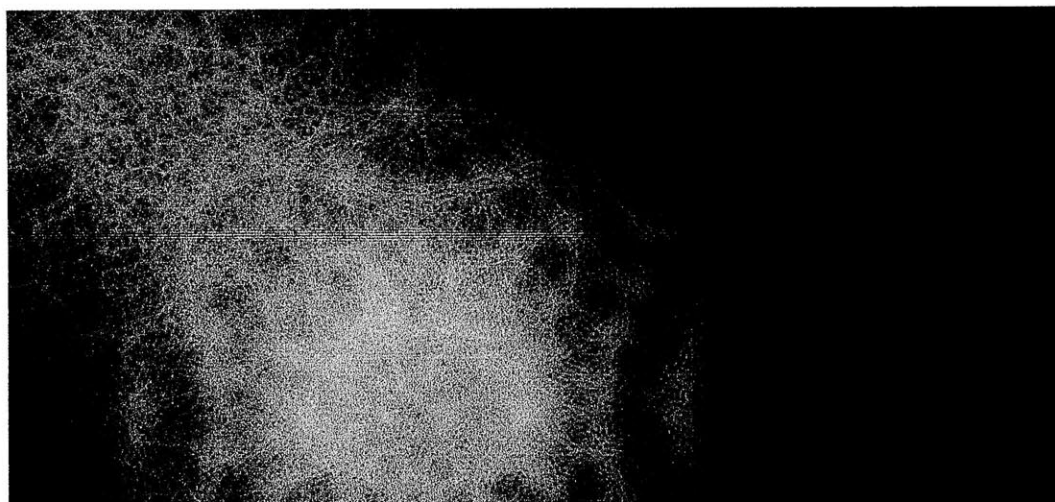


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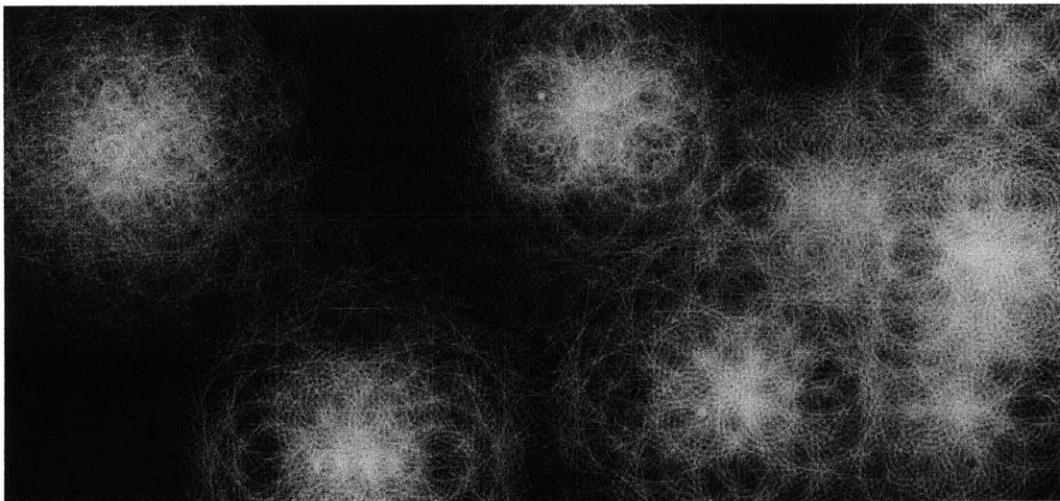
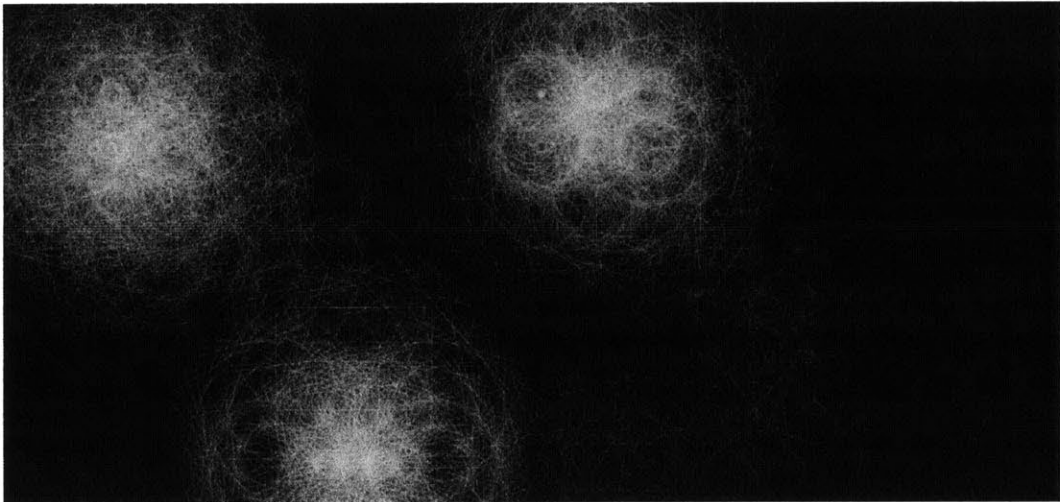
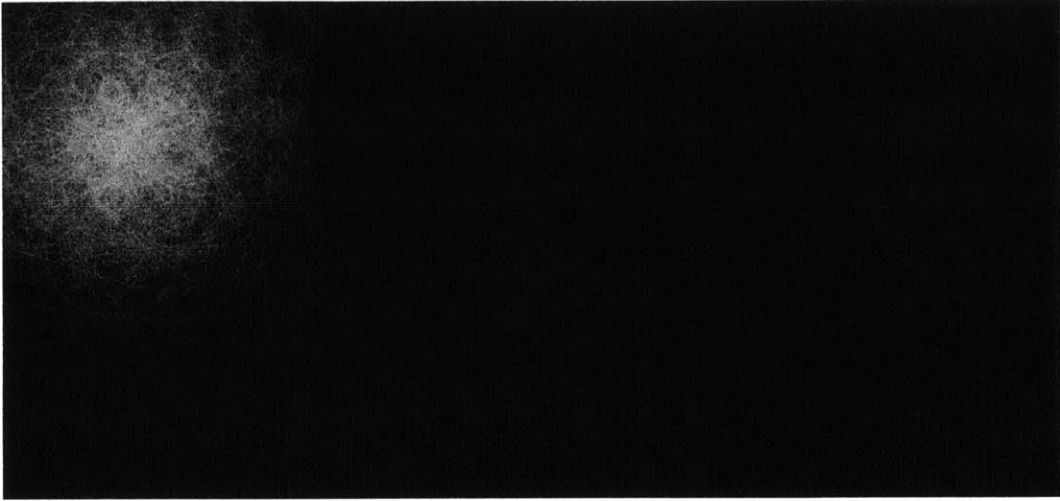


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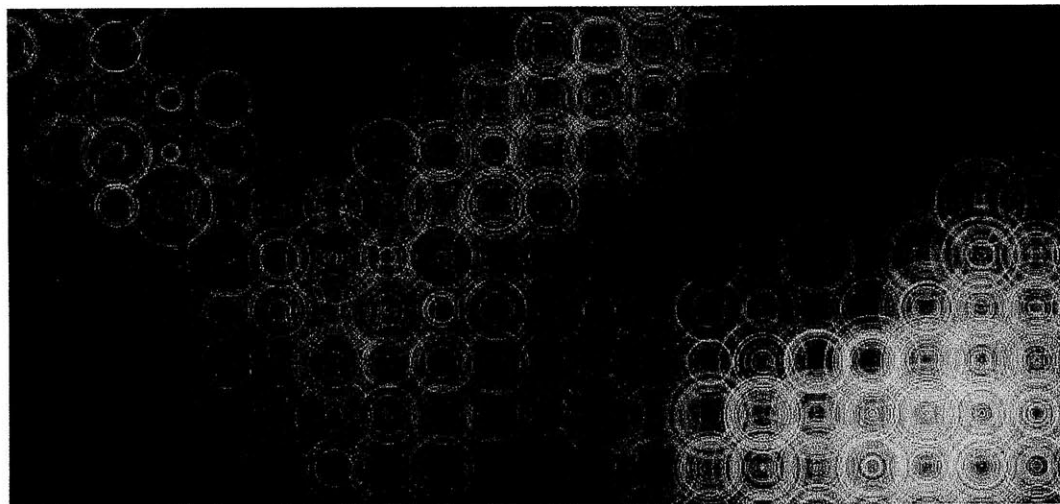
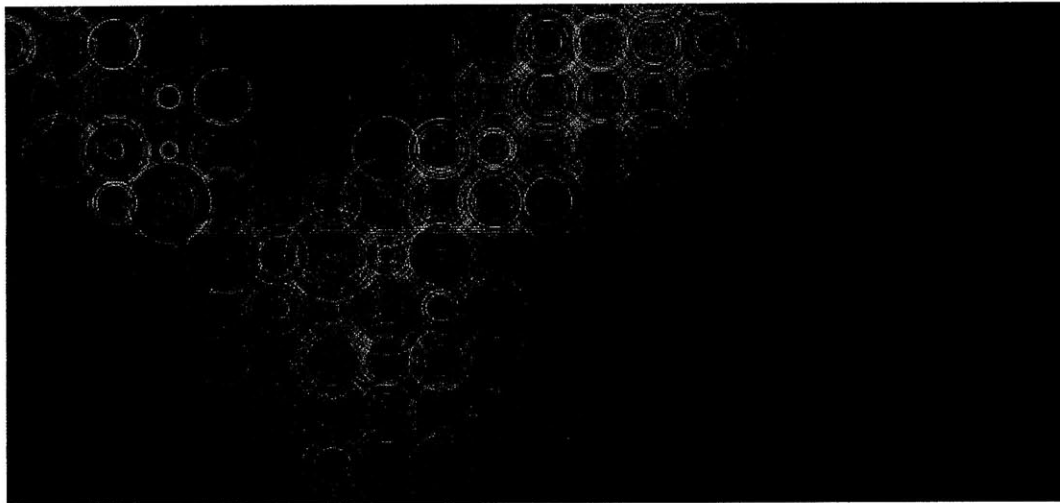
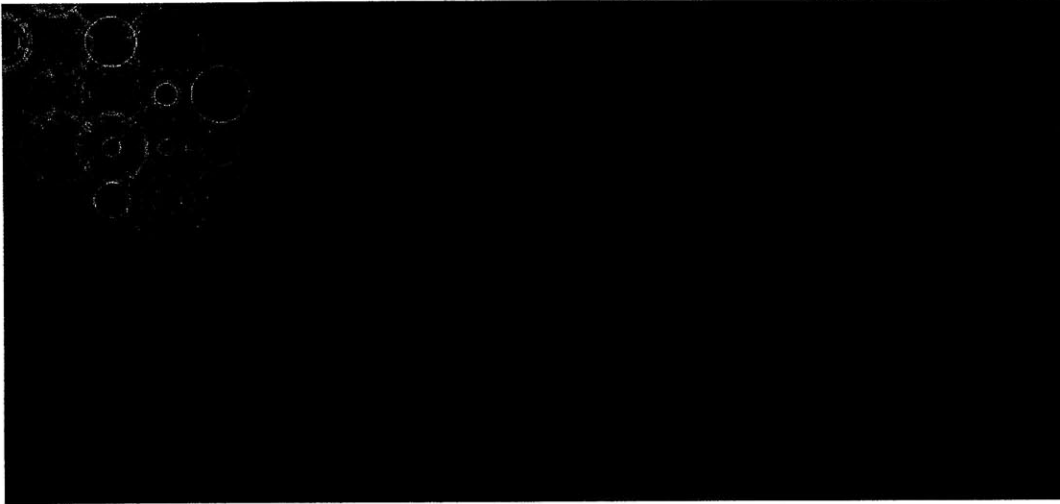


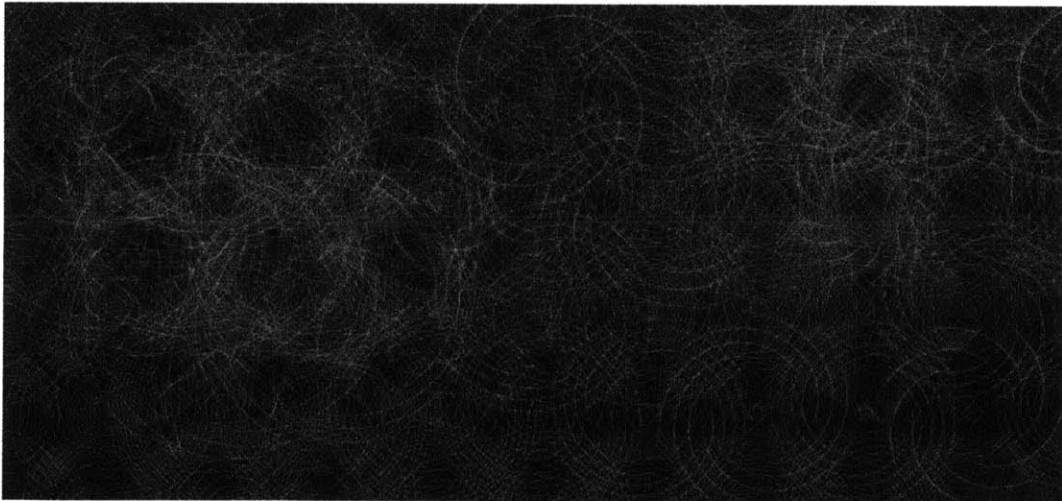
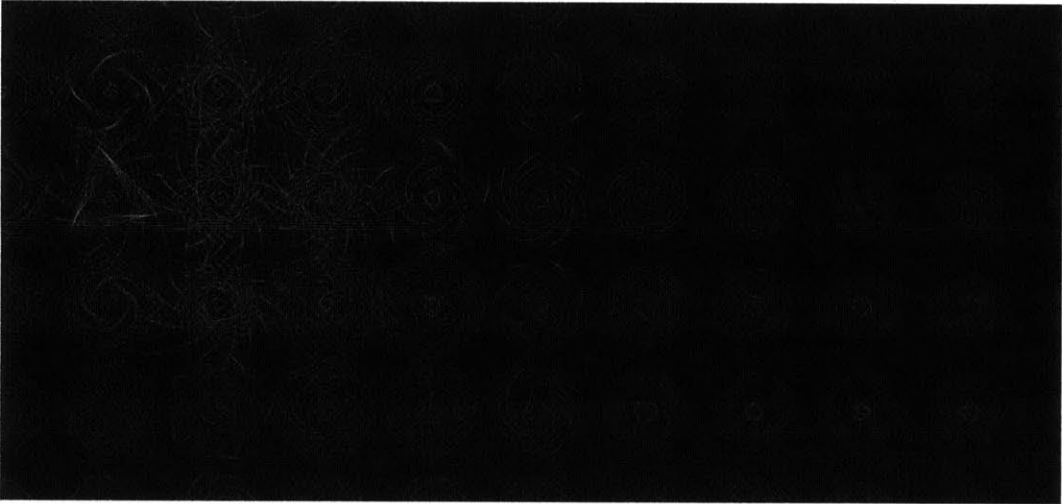
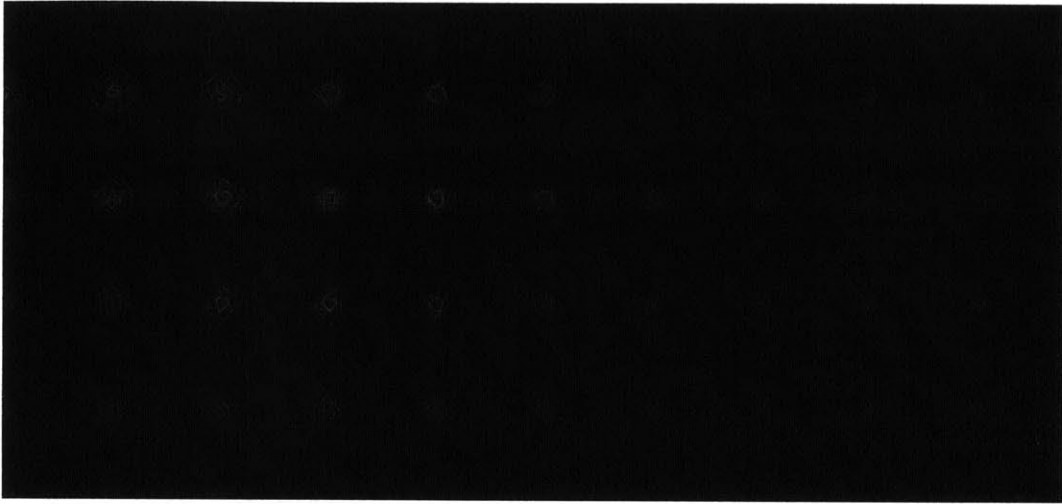


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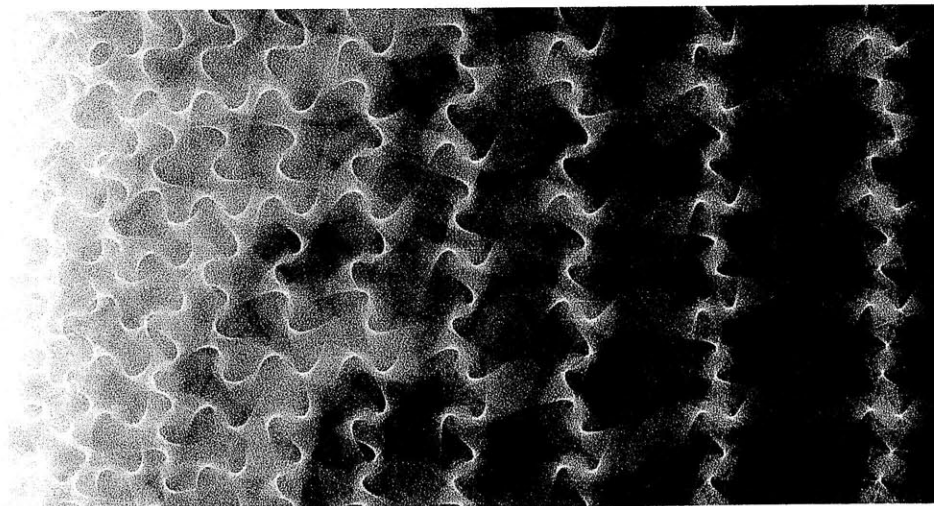
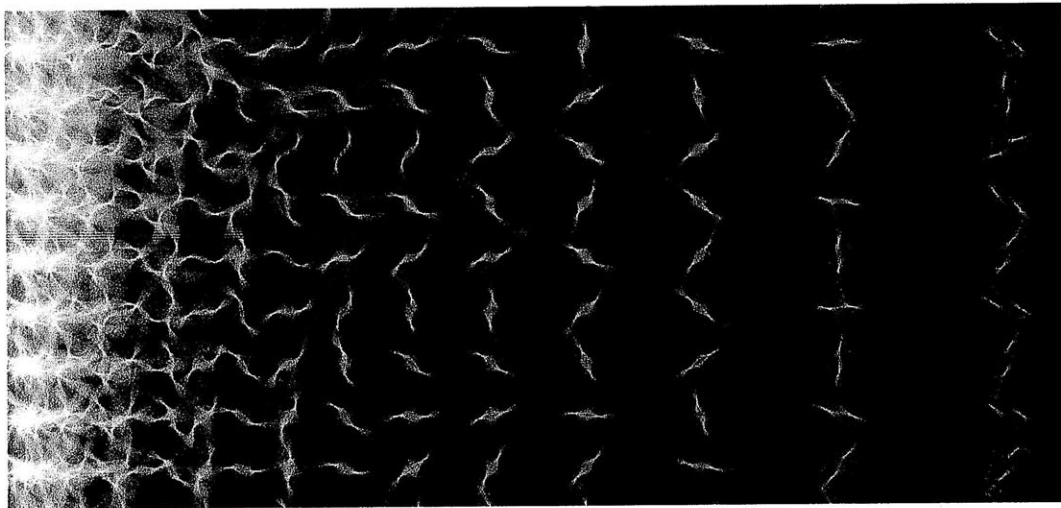
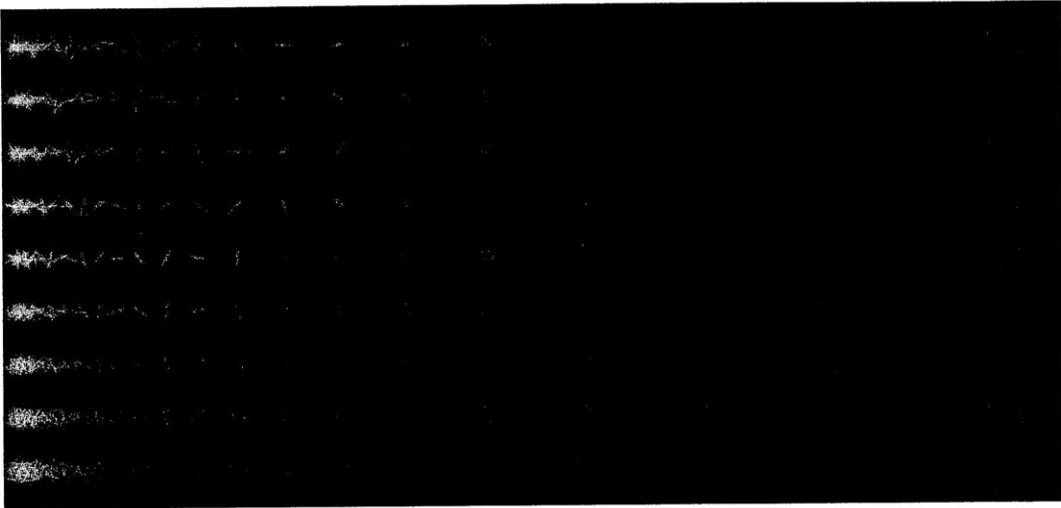


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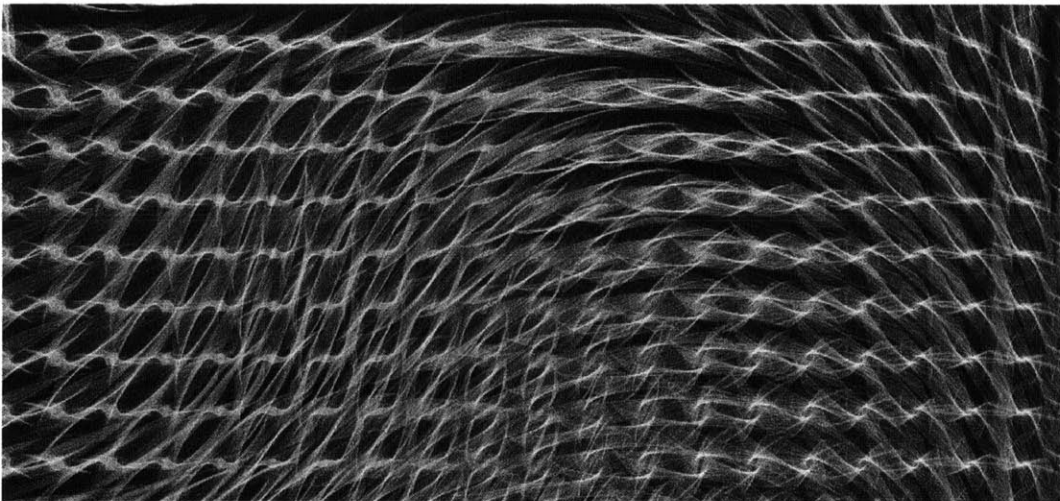
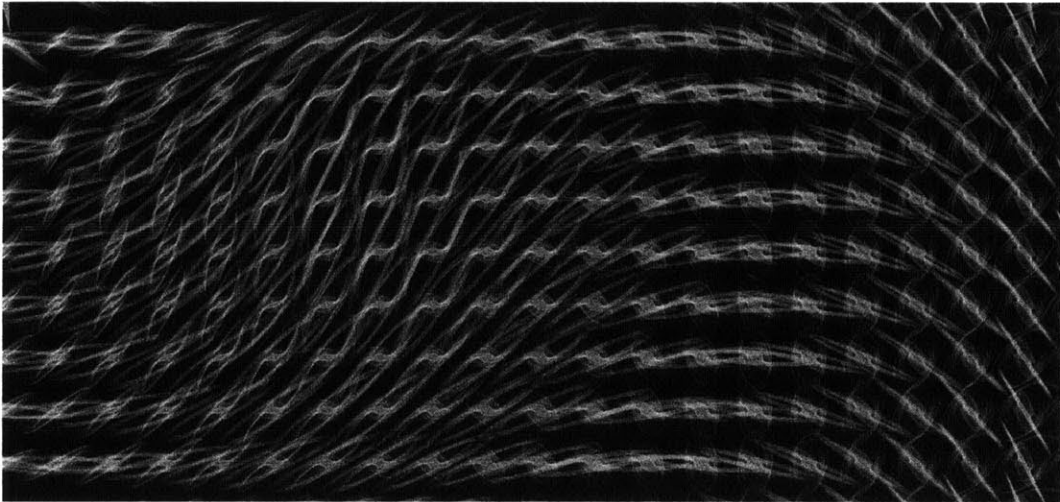
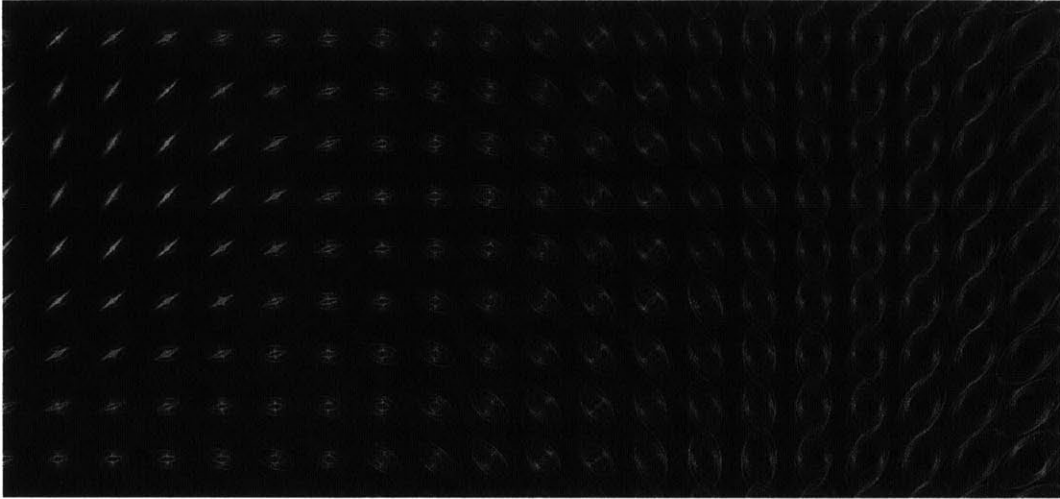




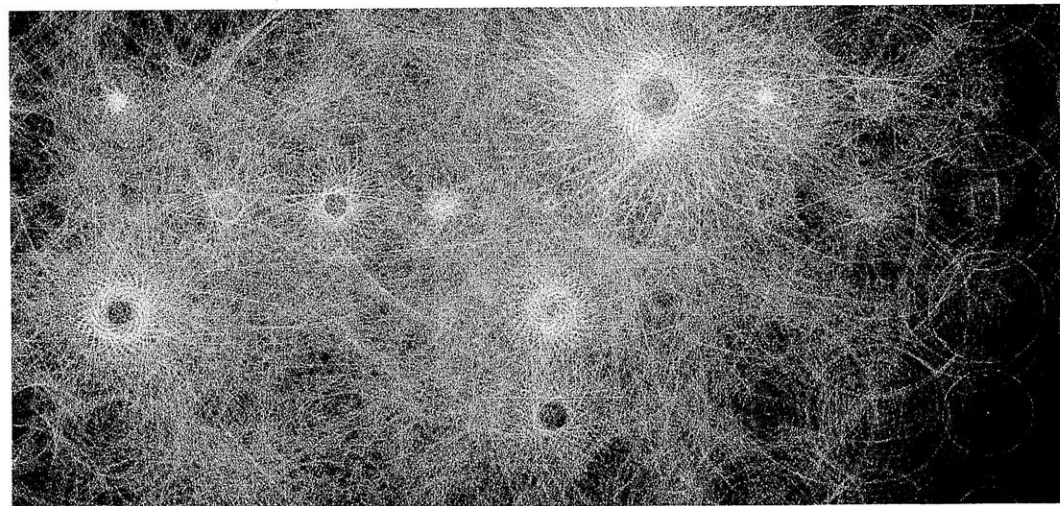
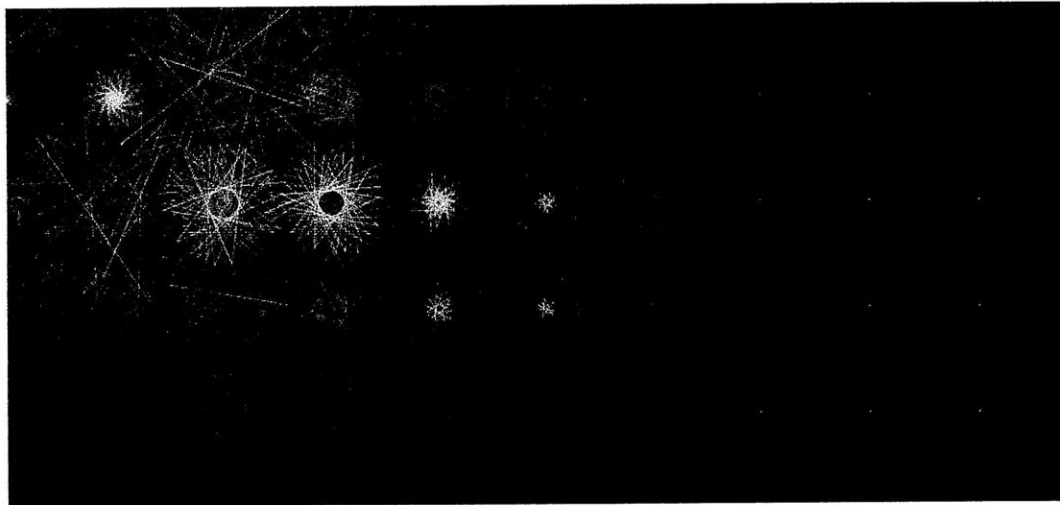
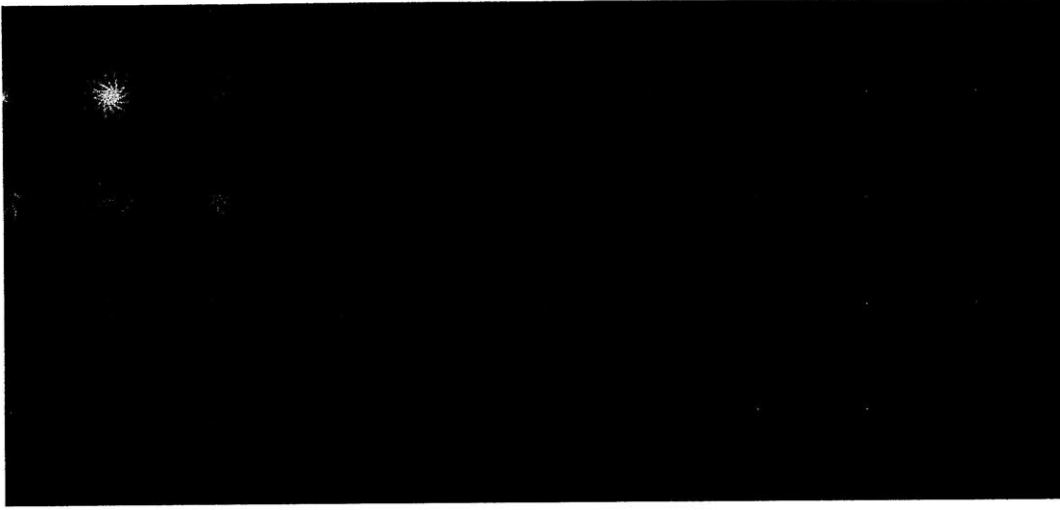
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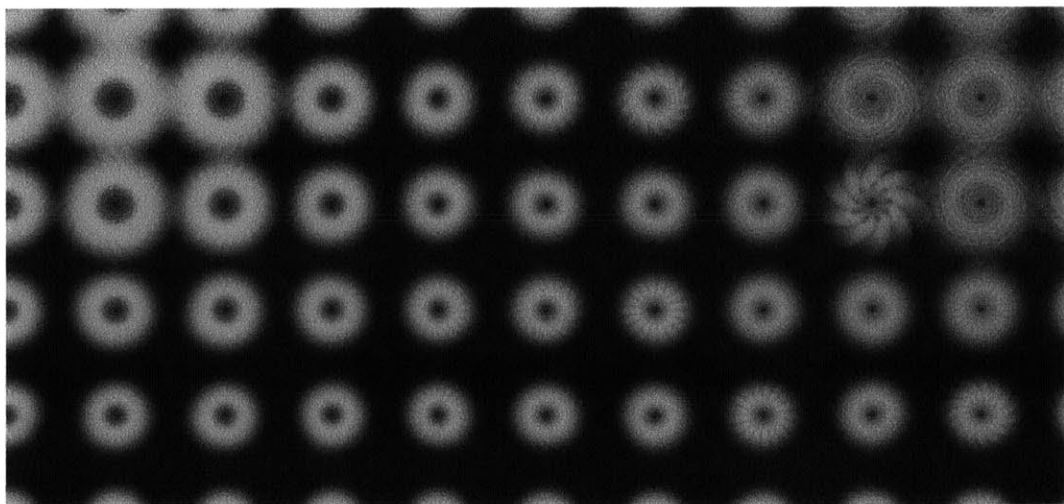
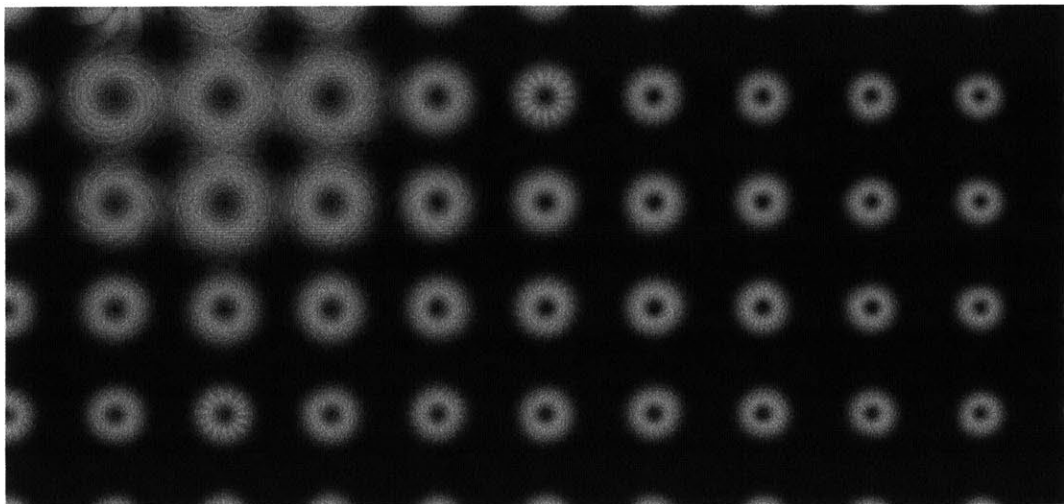
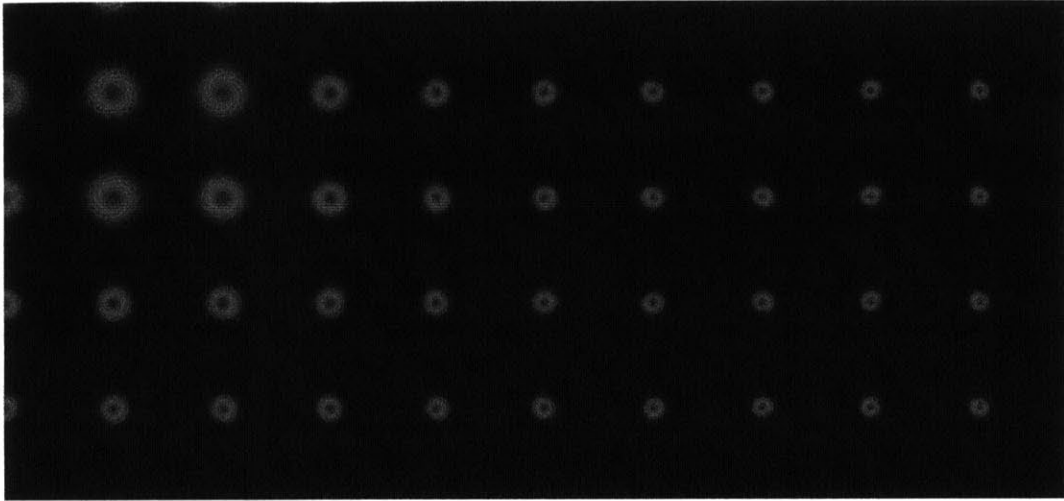
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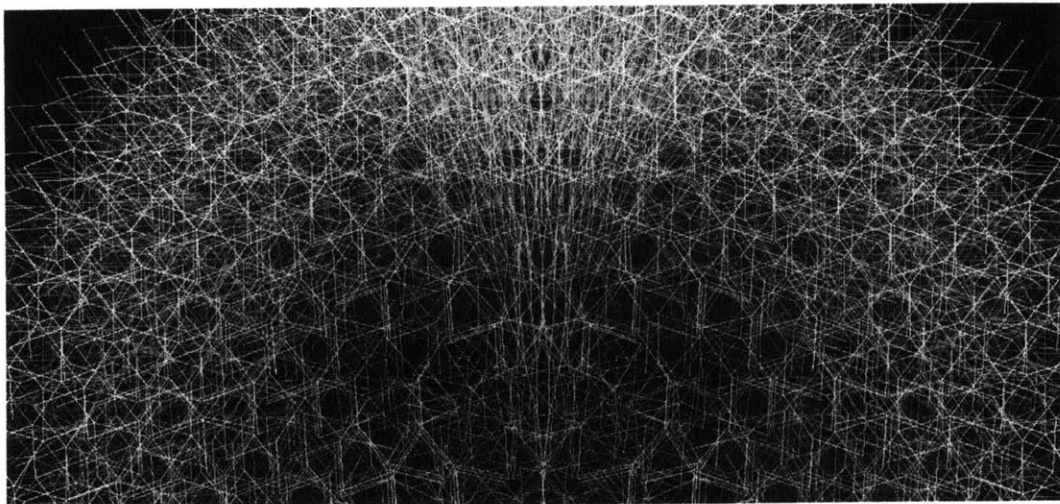
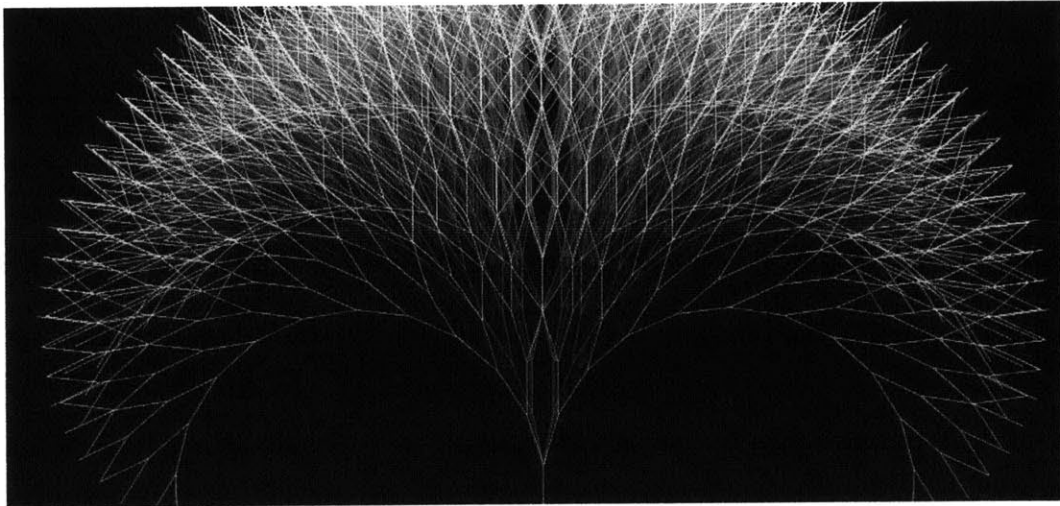
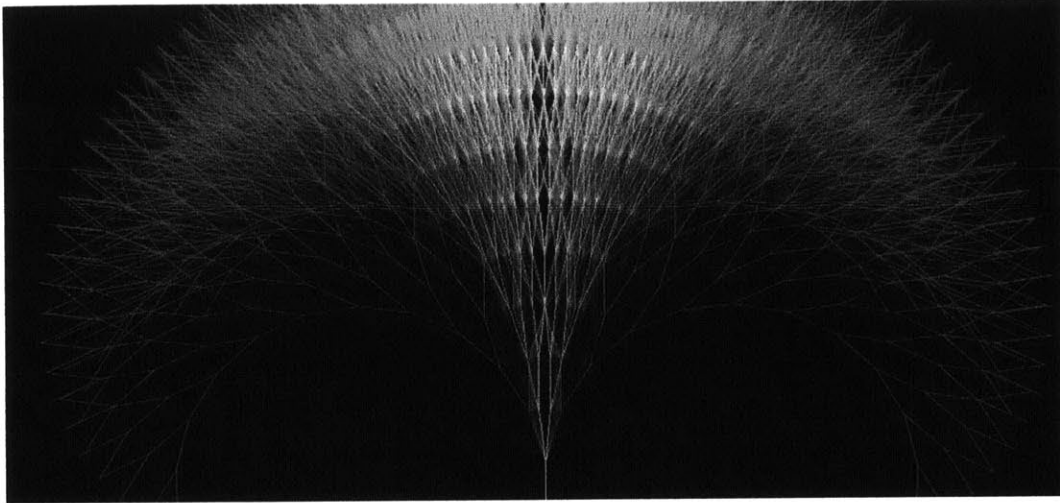
Phase 03: growth behavior

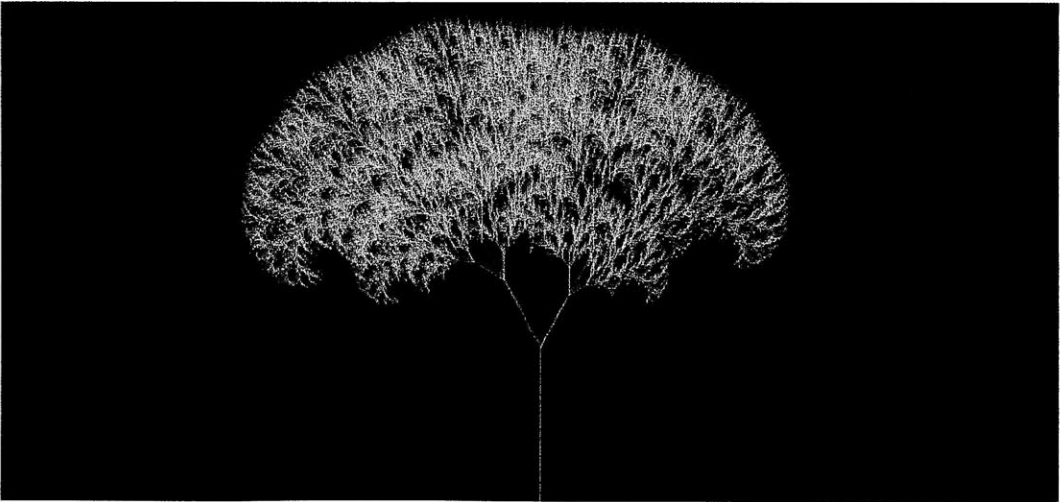
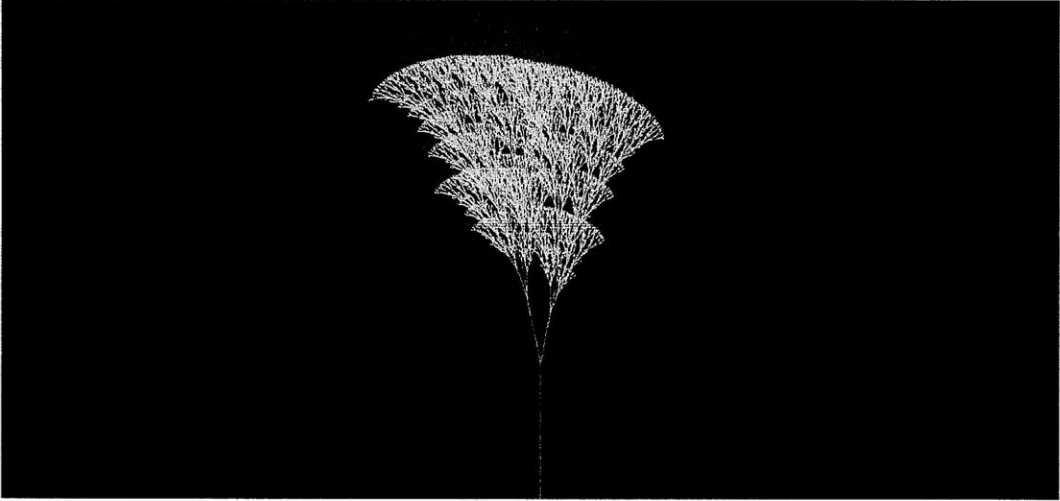
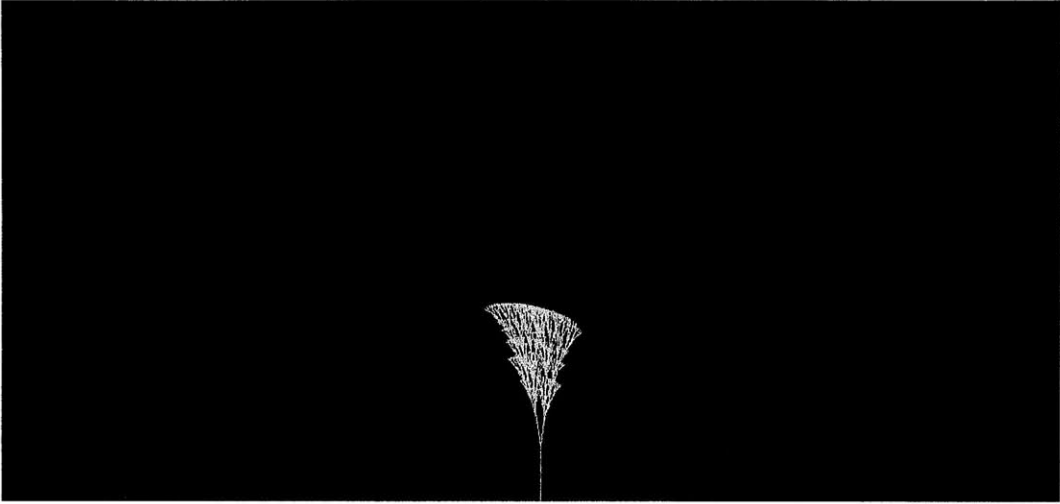
This study analyzes three different forms of growth: layering, material redistribution and self similarity. Each growth category uses diagrammatic real world examples to visualize the relationship between geometry generating algorithms and algorithm controlling milieus.

The examples vary in scale from geological systems such as volcanoes and deserts to rubber bands or corals. In general, the growth strategies themselves can be considered scaleless. In the examples scale is simply used as a reference in order to move away from abstract systems.

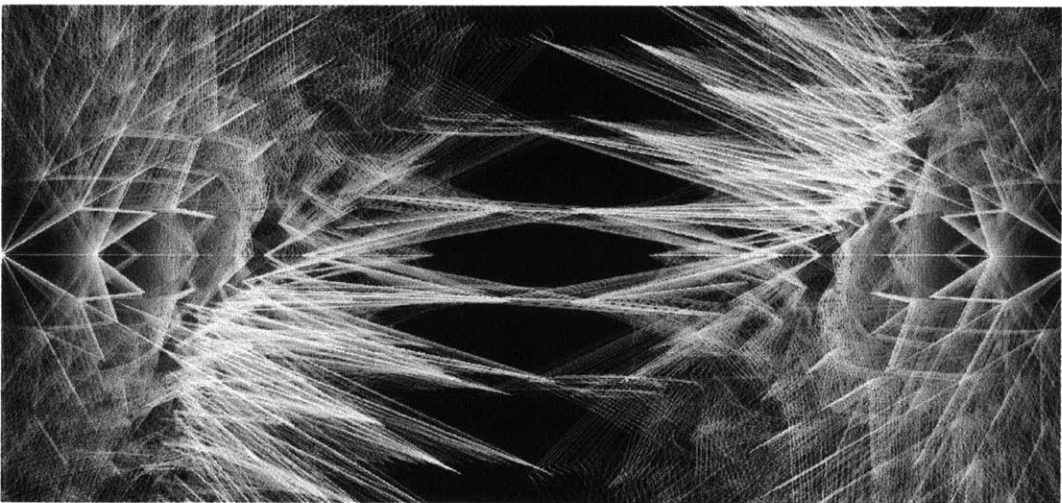
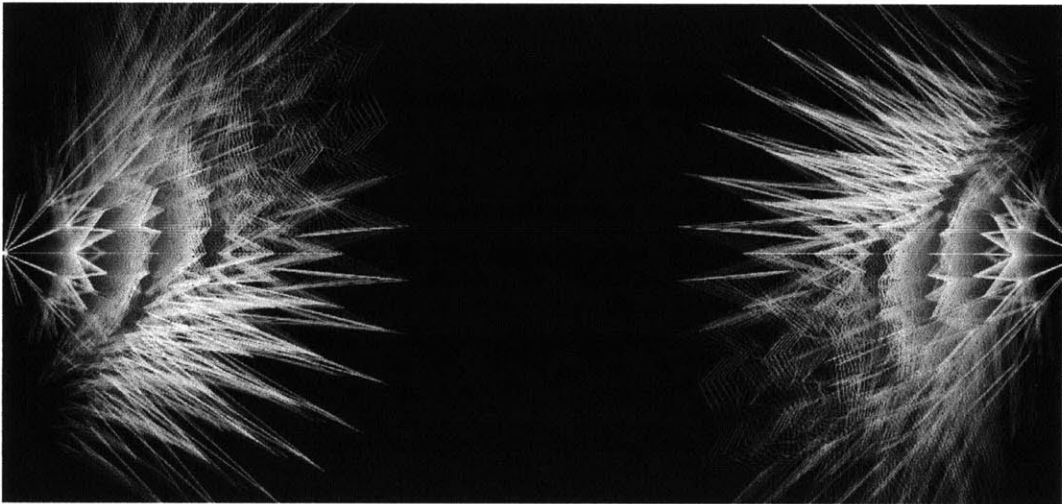
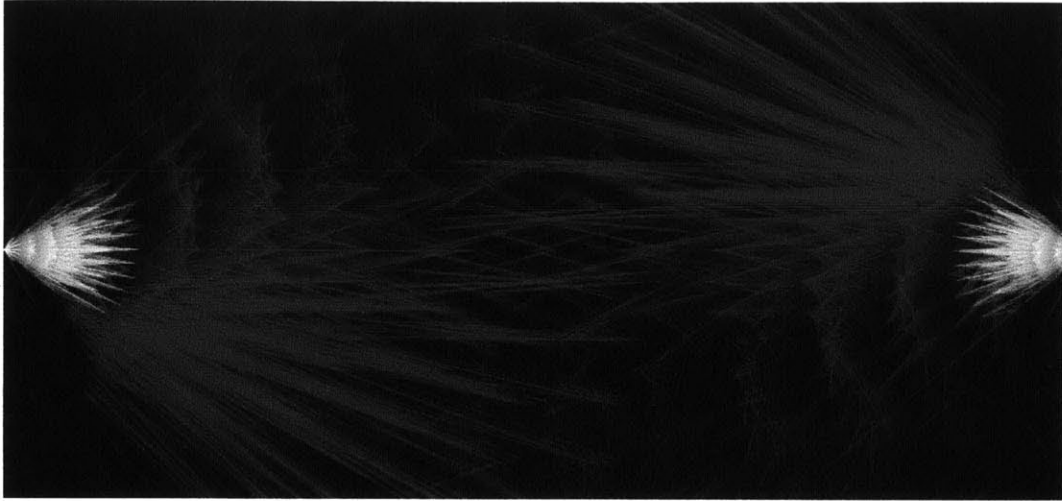
The first one or two examples in each category attempt to imitate real world growth systems as accurately as possible before becoming more abstract and deviating from reality in order to allow for speculation to enter the design process.

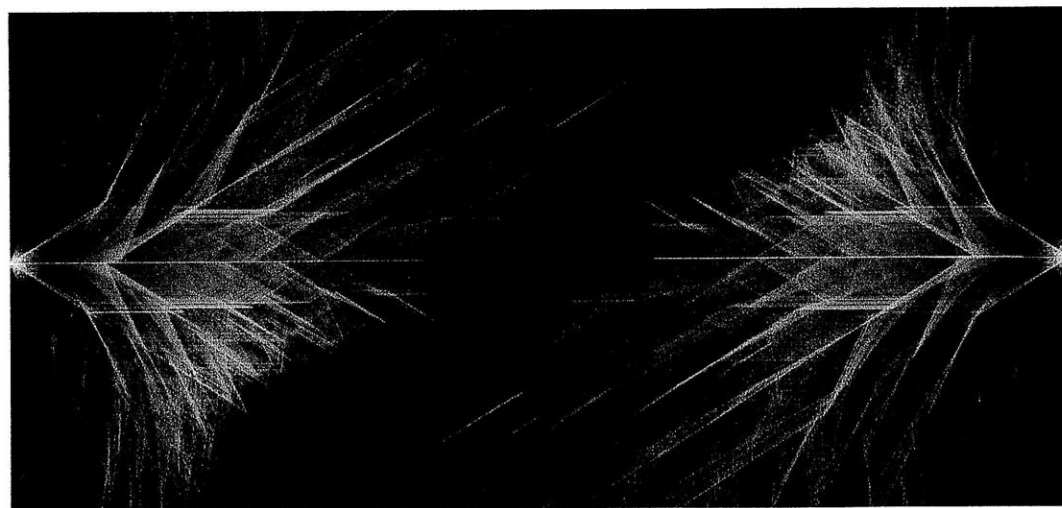
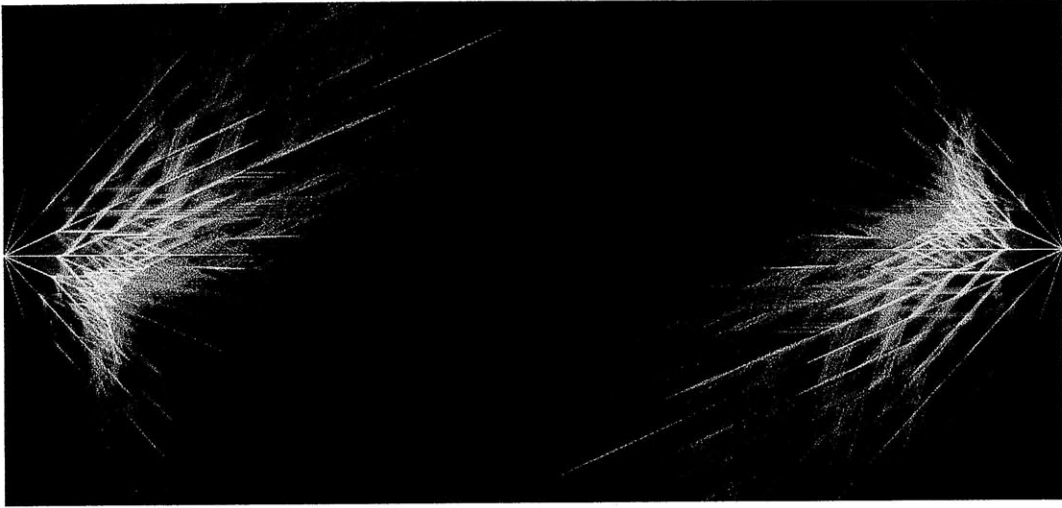
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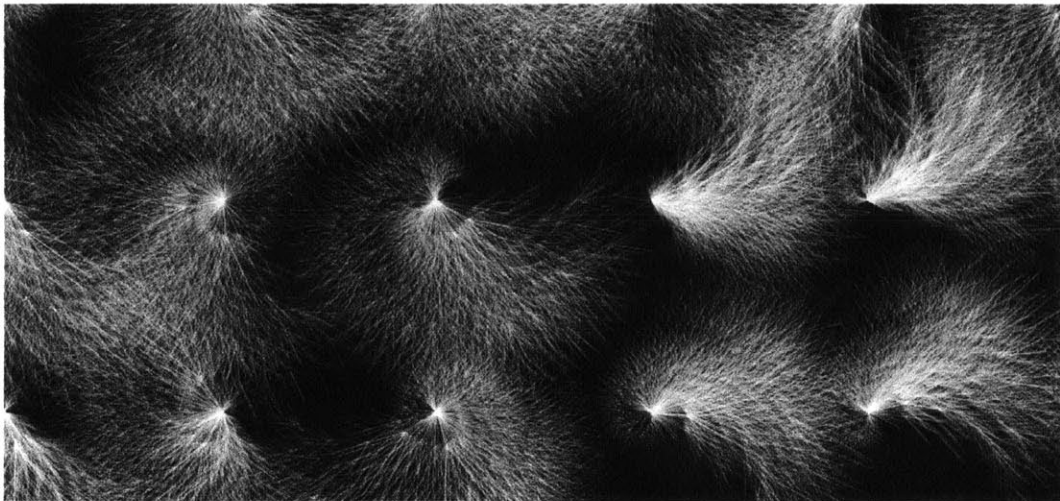
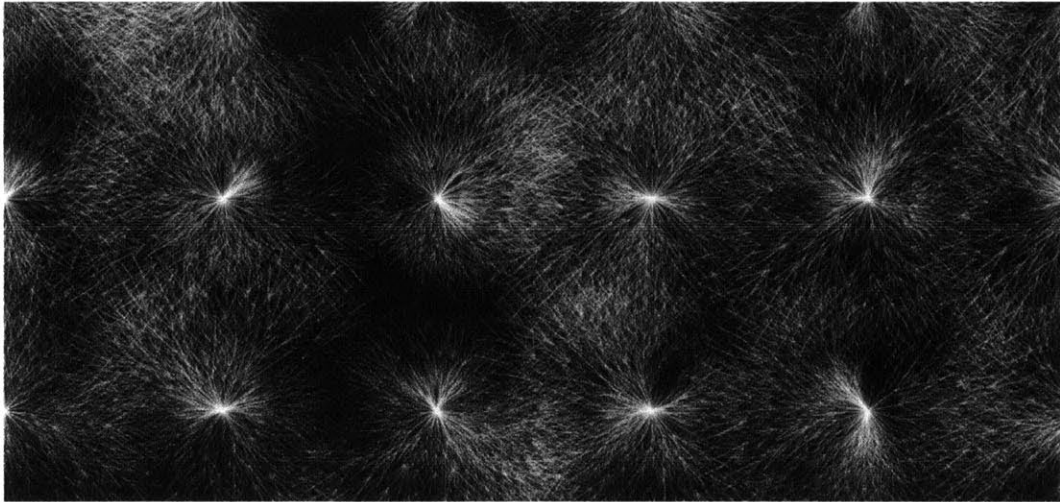
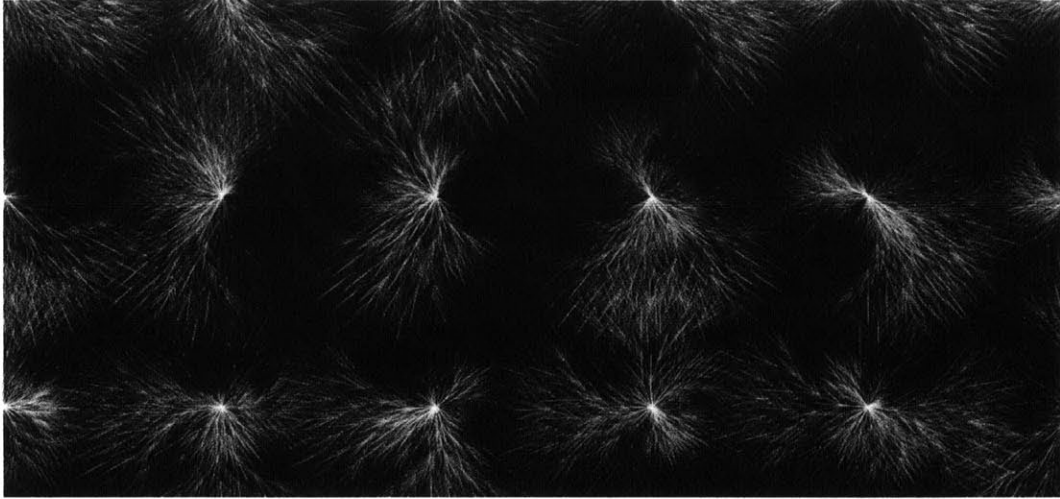


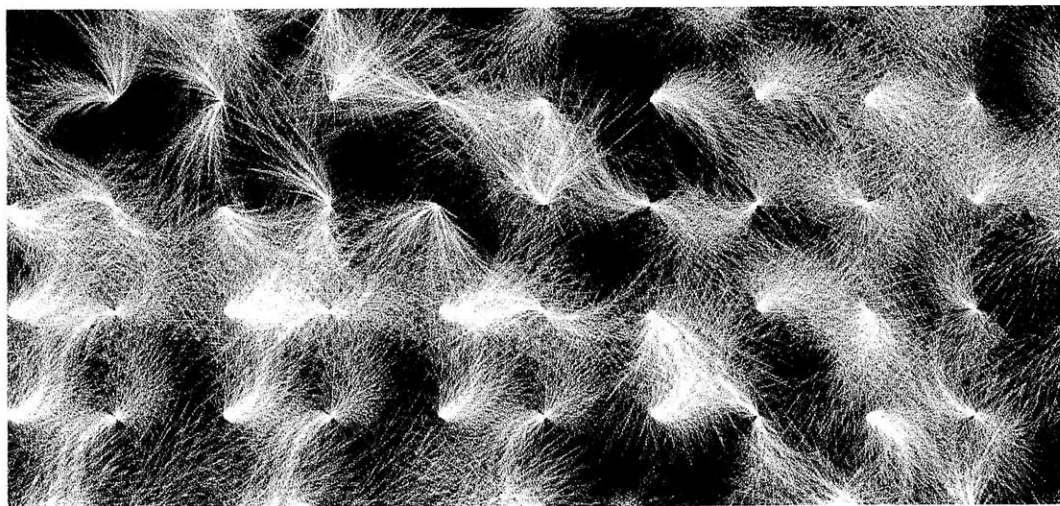
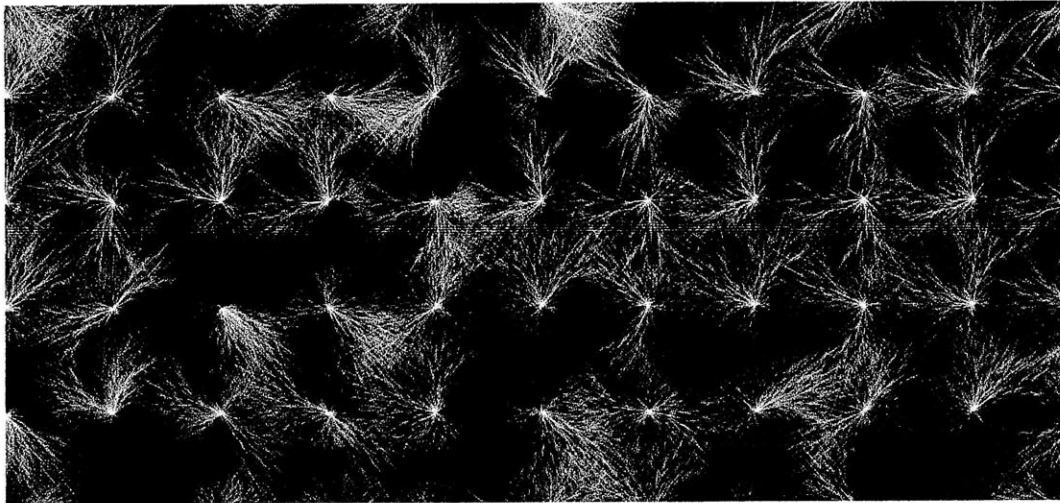
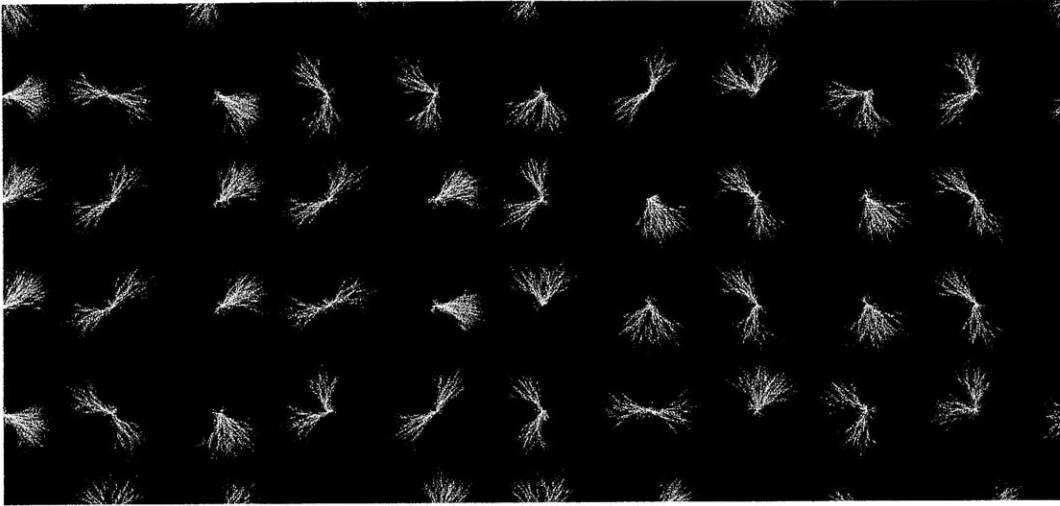
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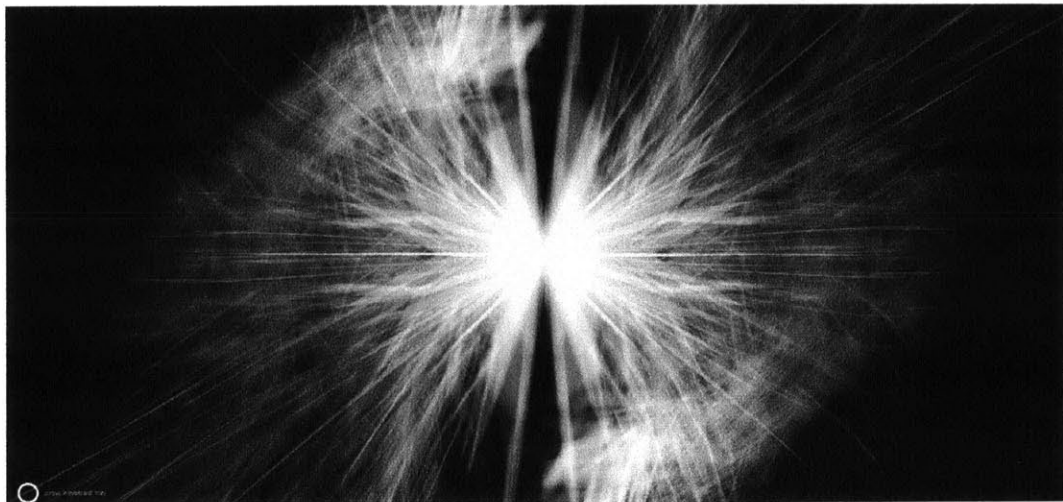
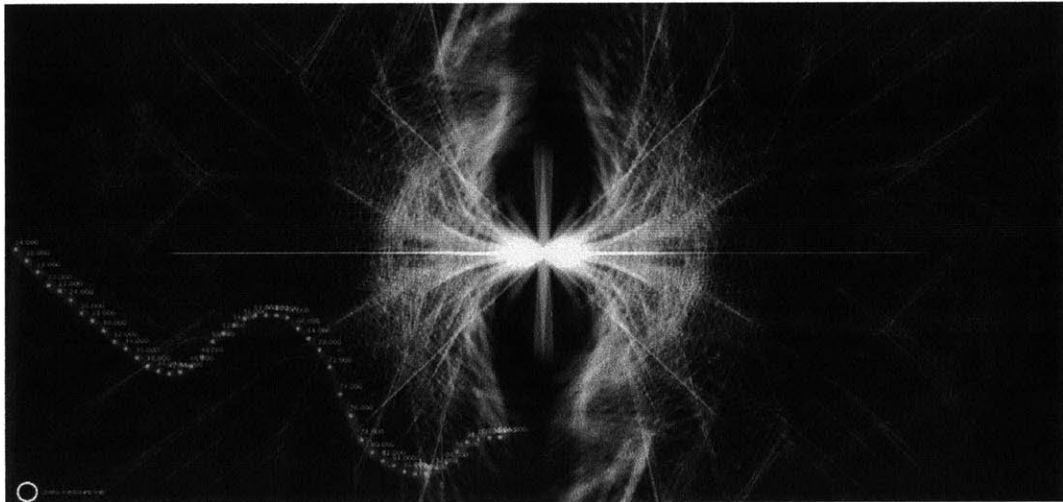
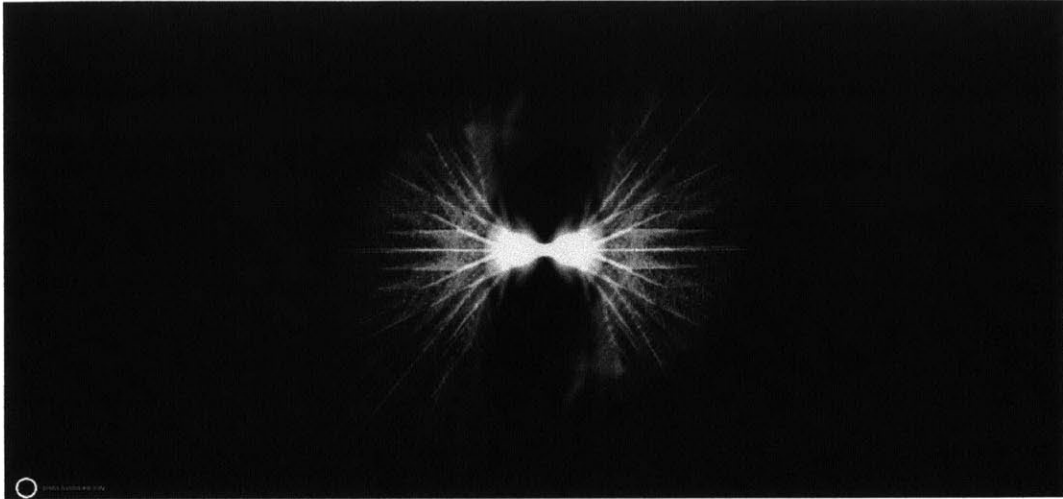


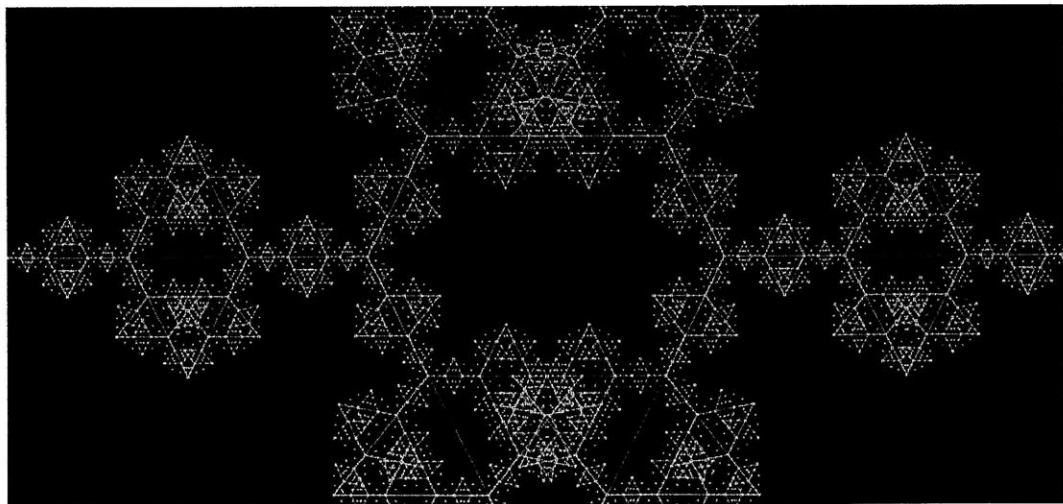
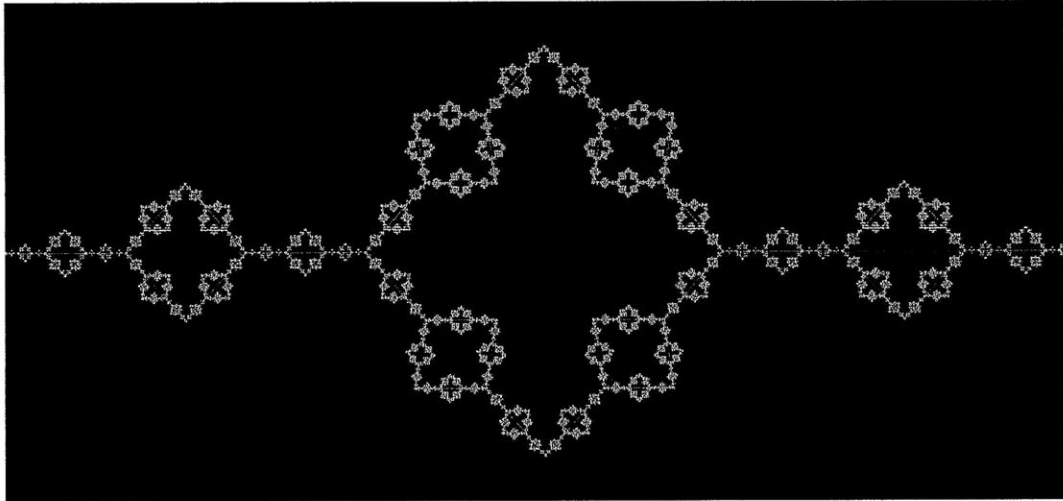
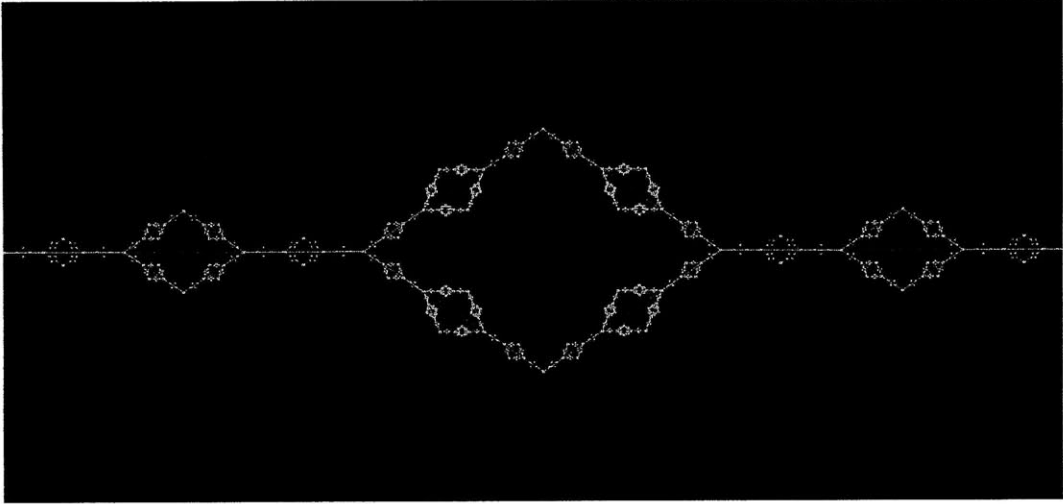
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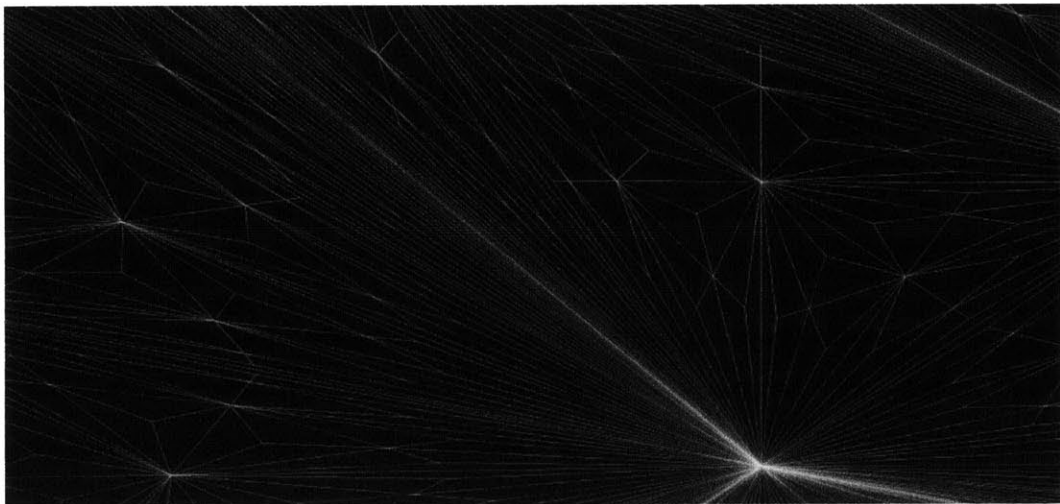
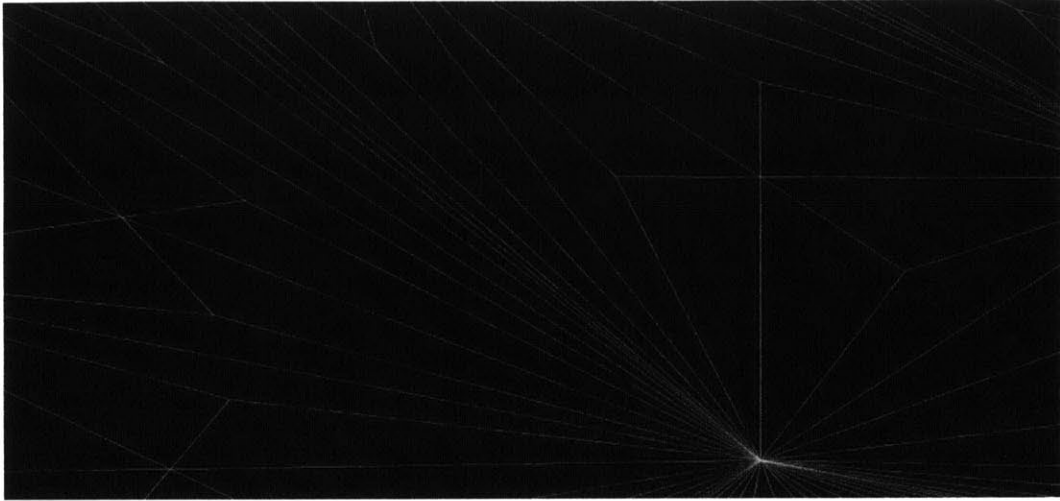


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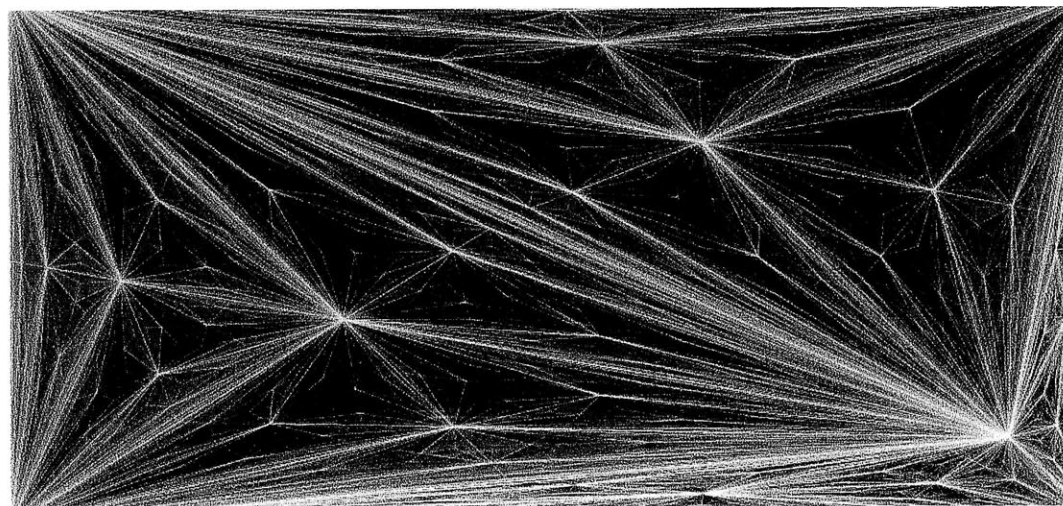
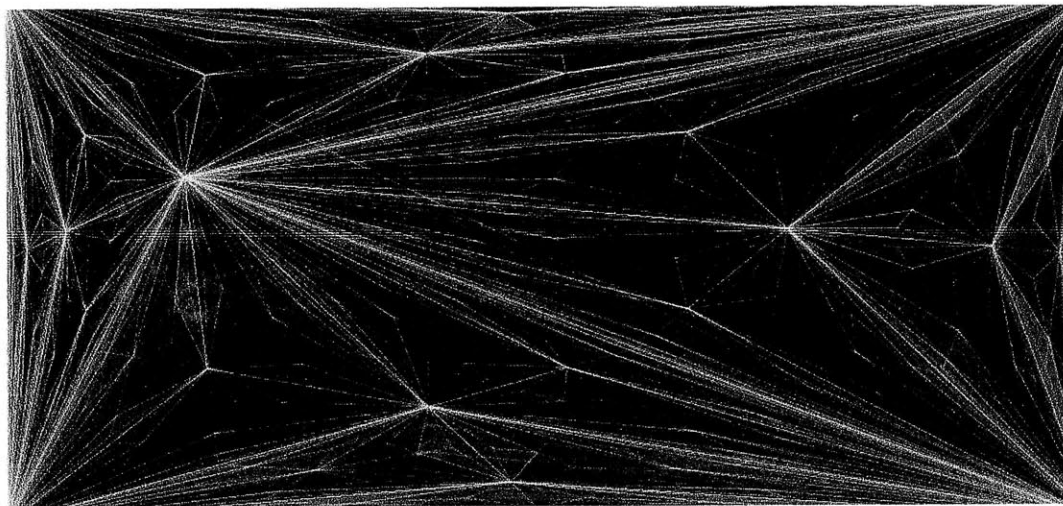
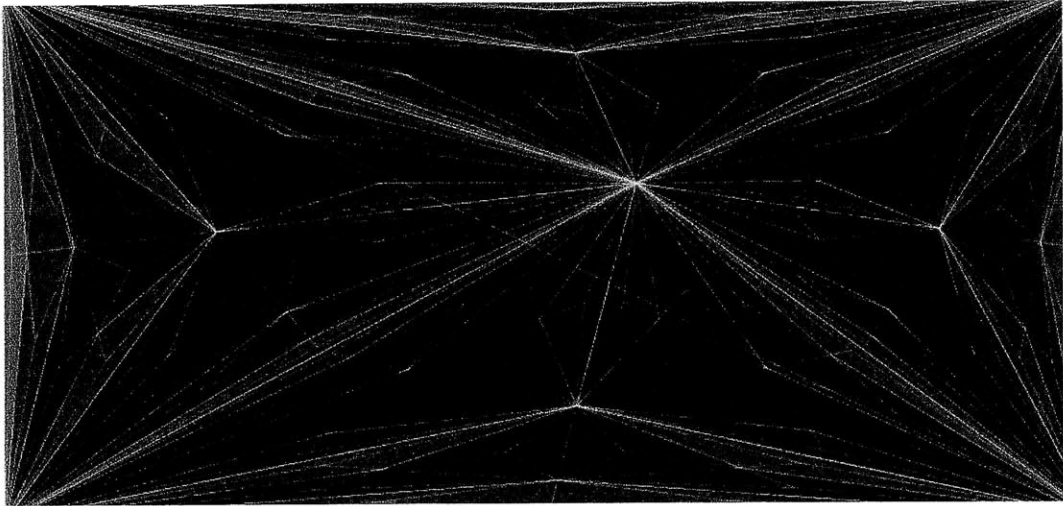




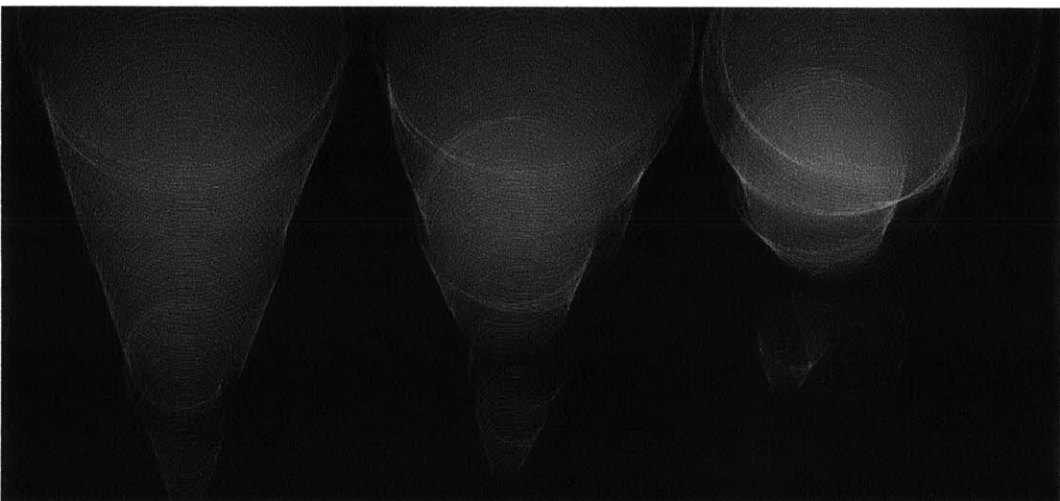
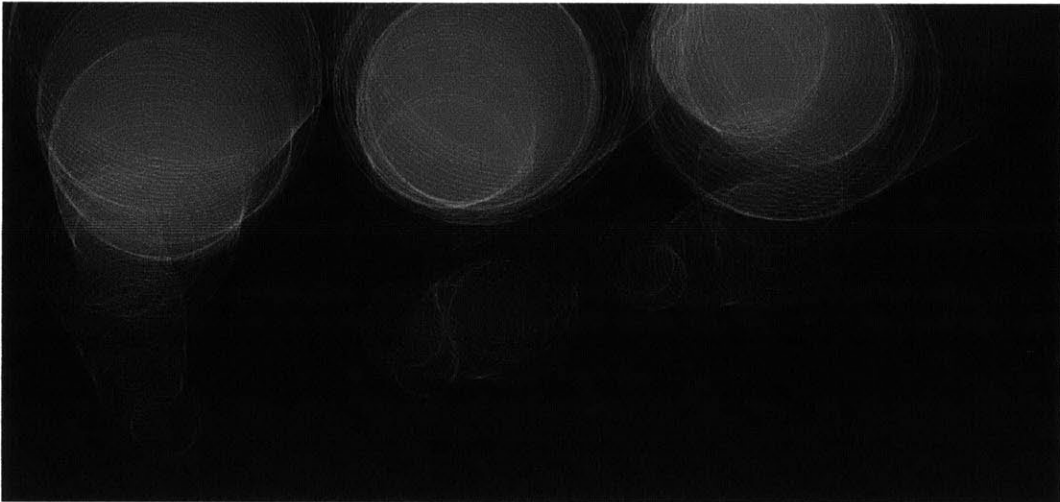
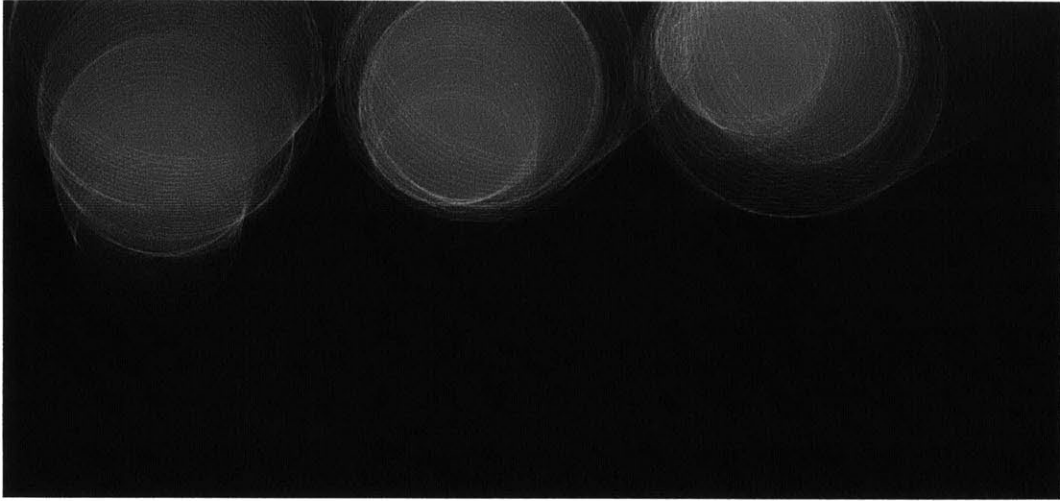
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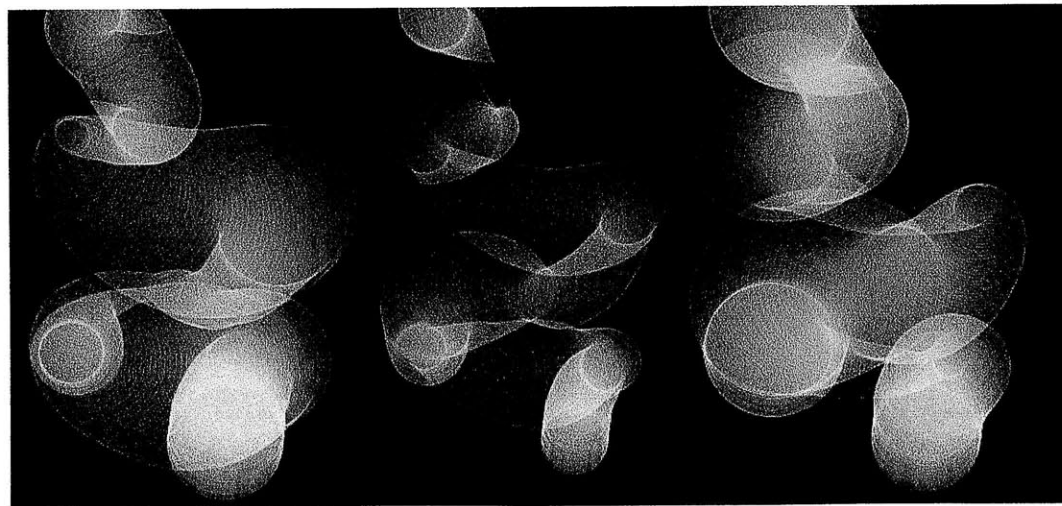
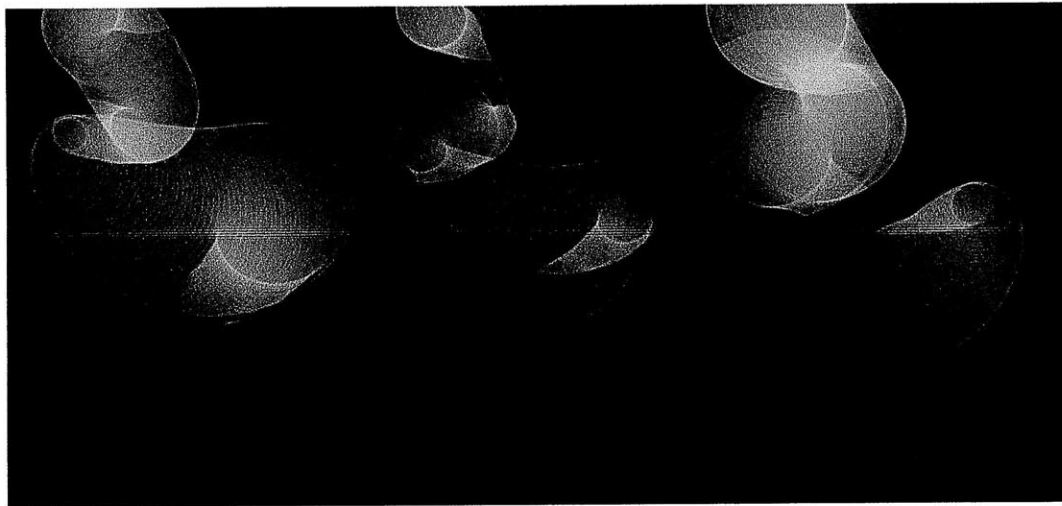
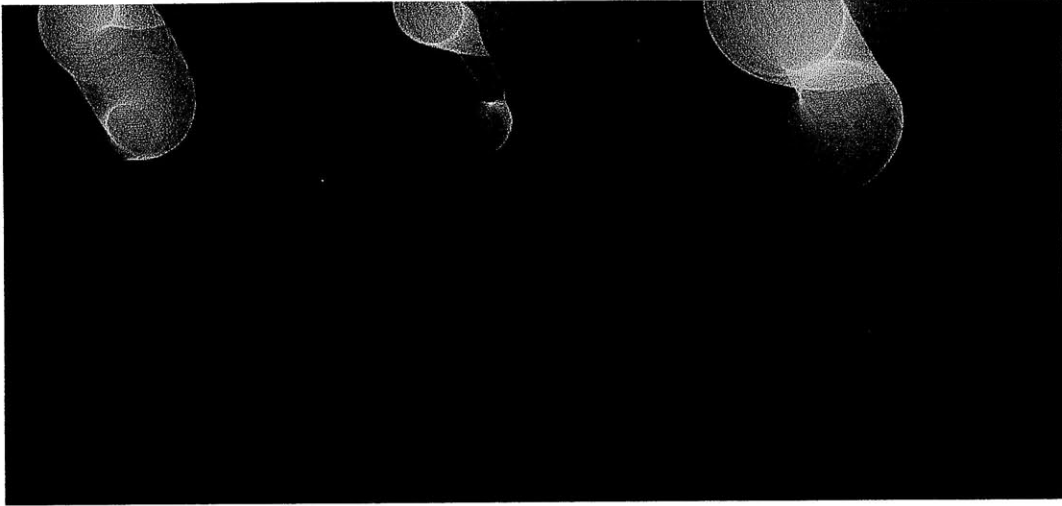
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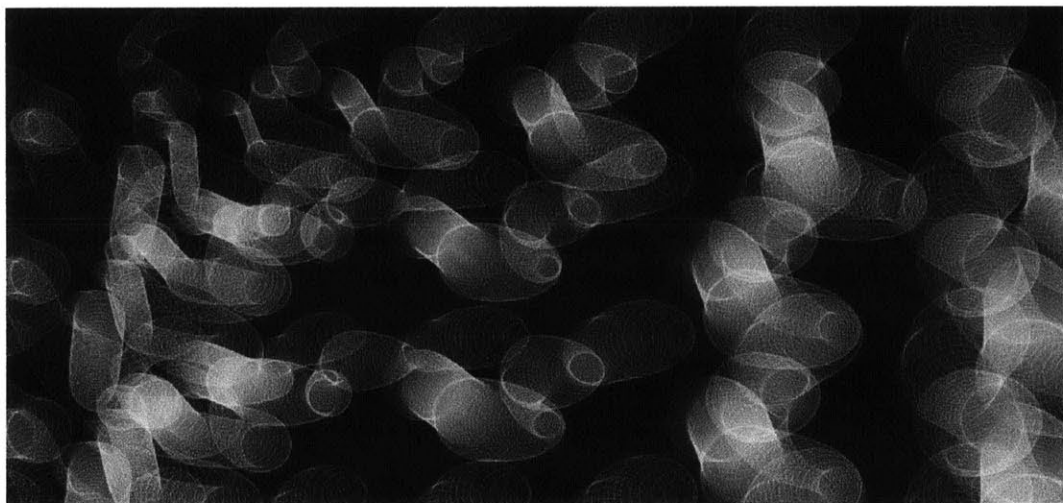
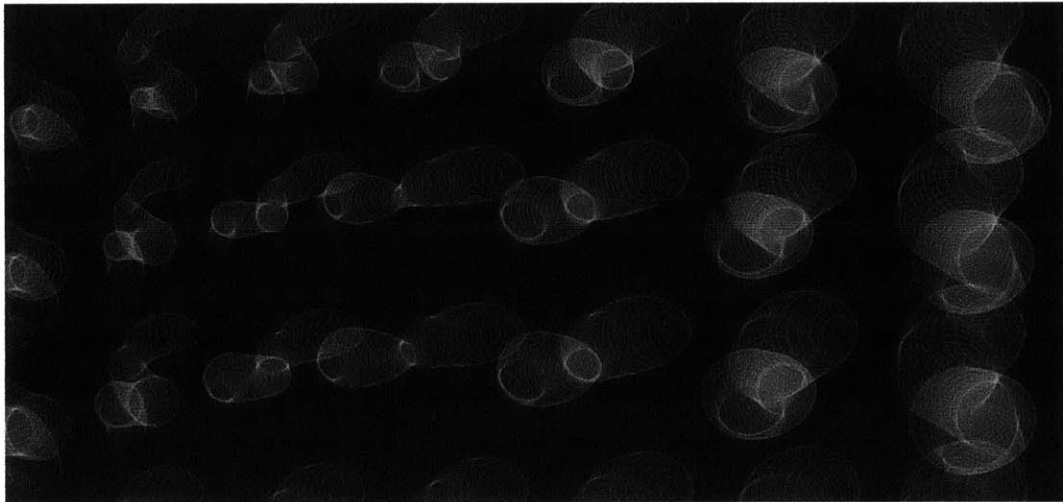
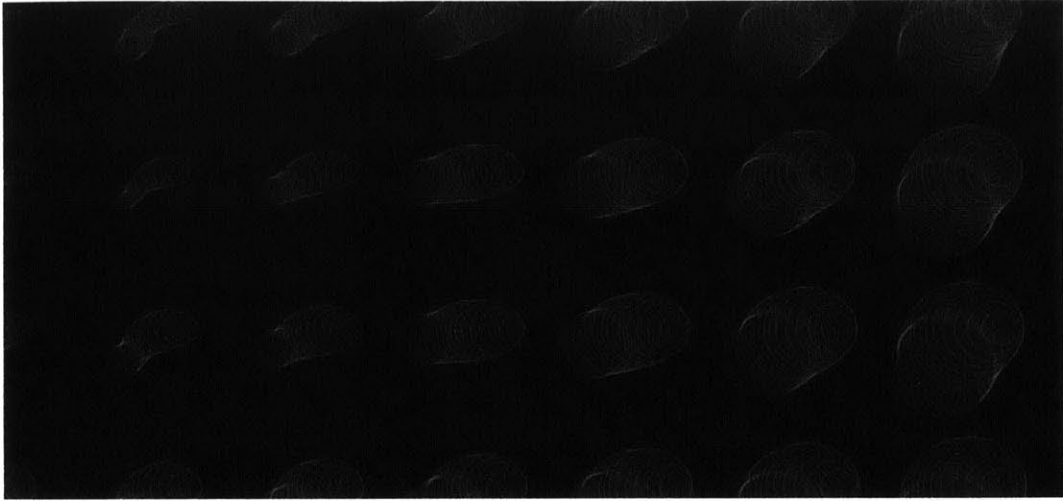


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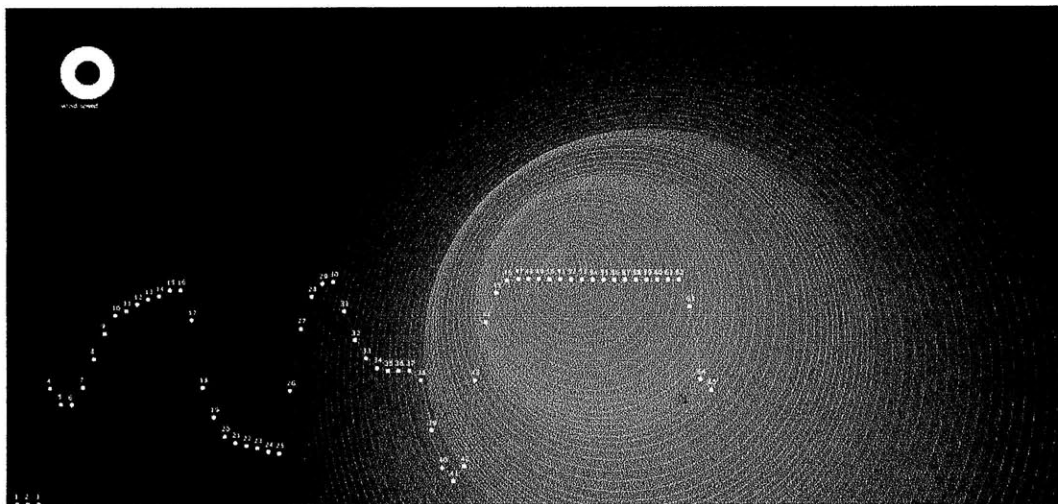
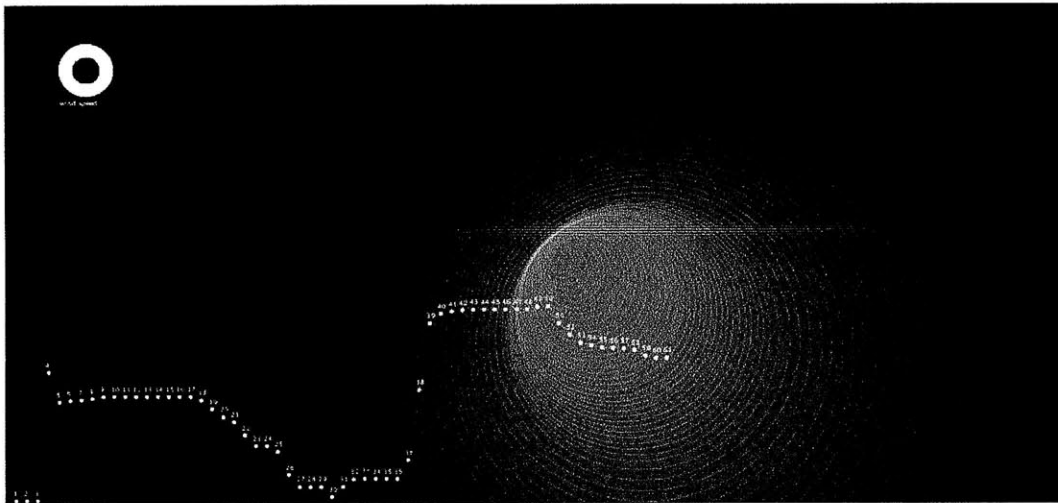


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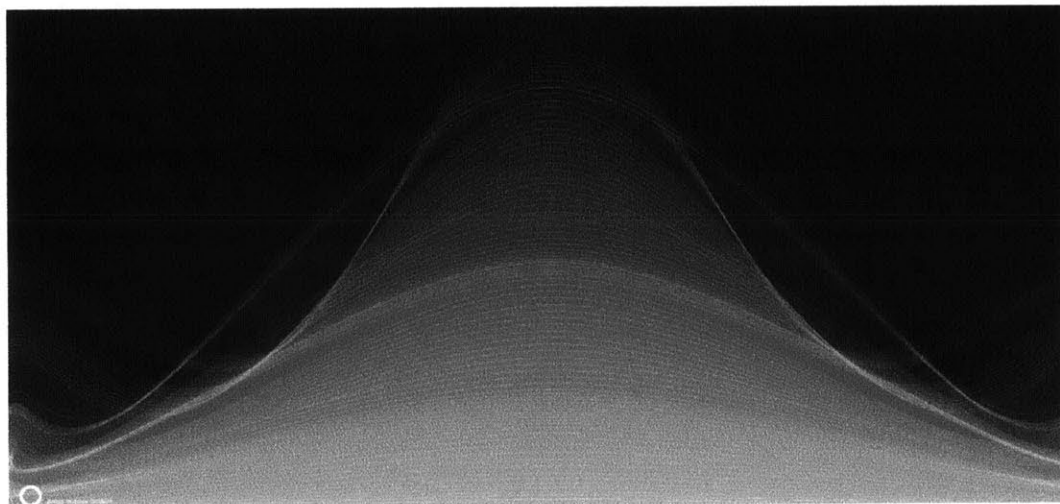
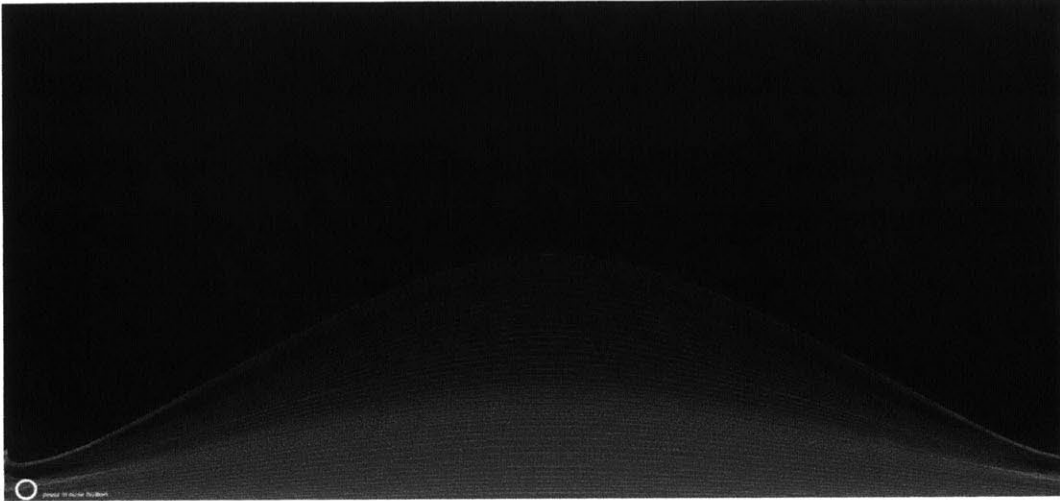




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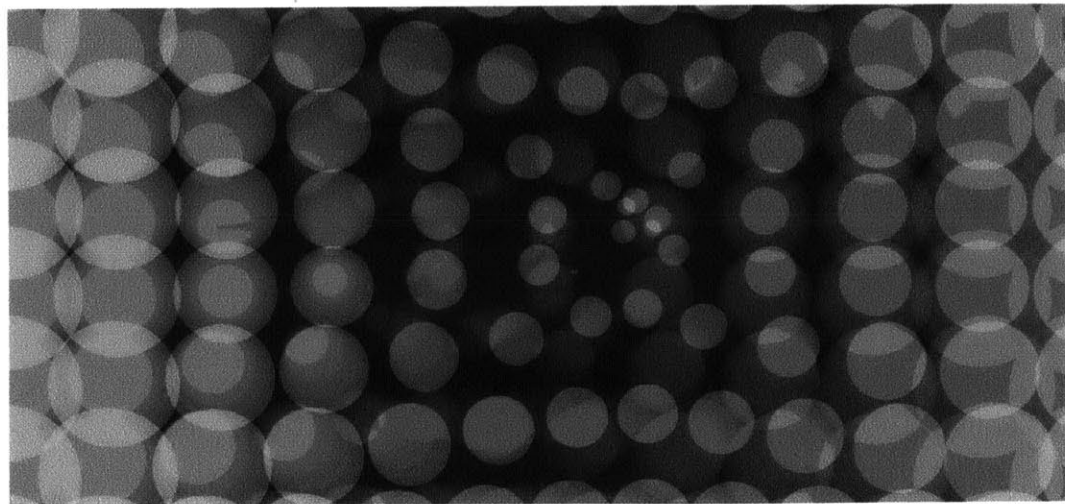
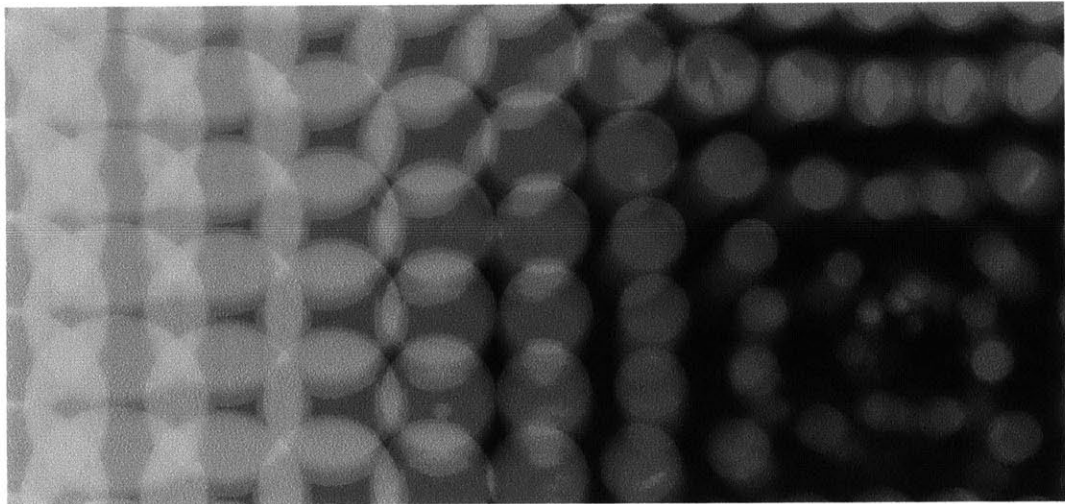
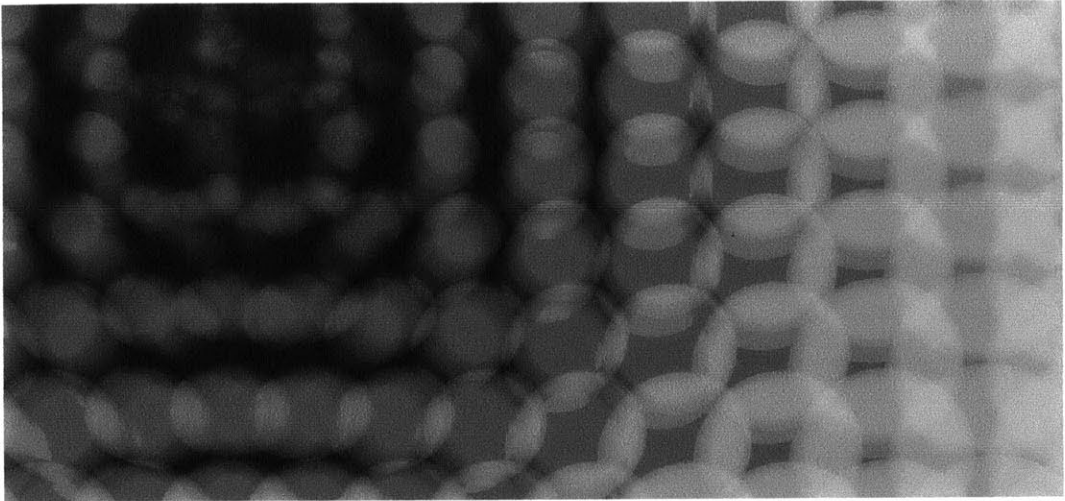
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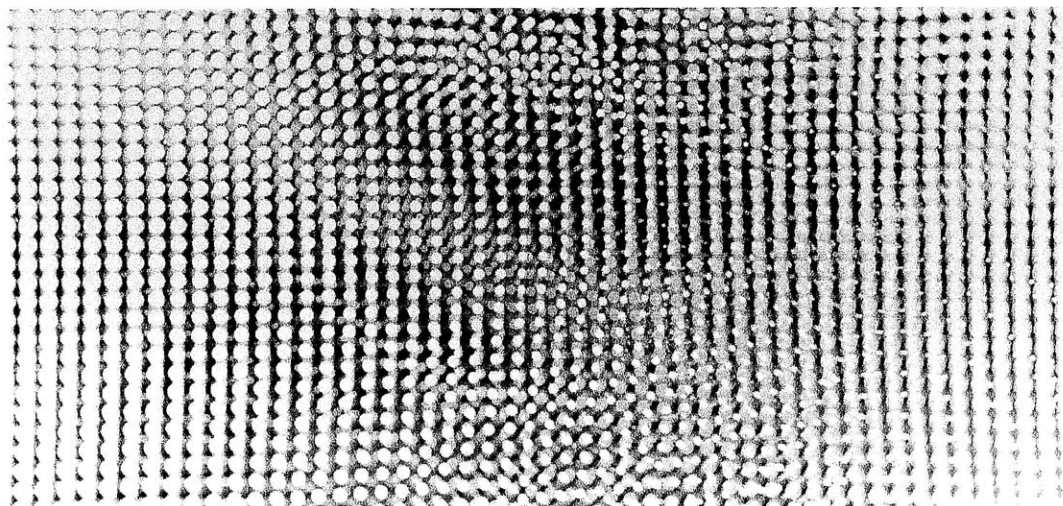
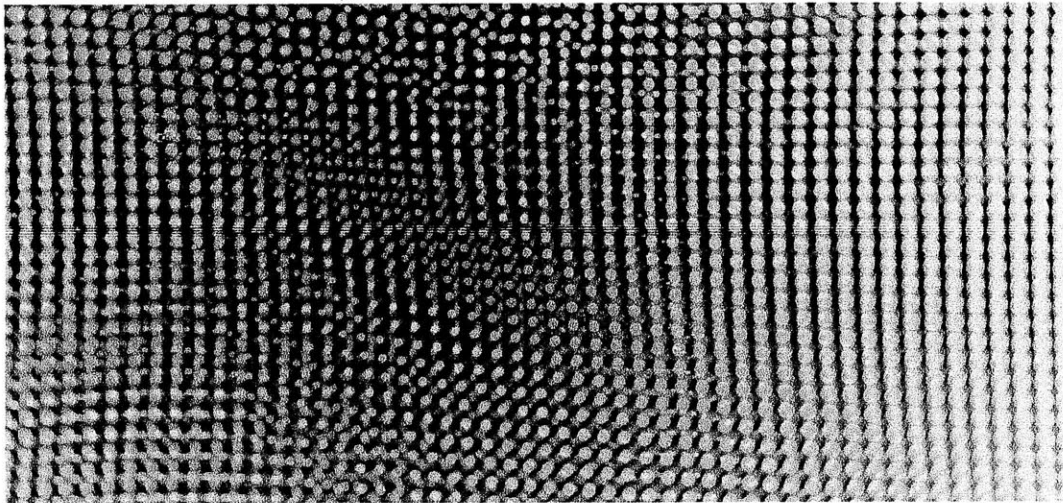
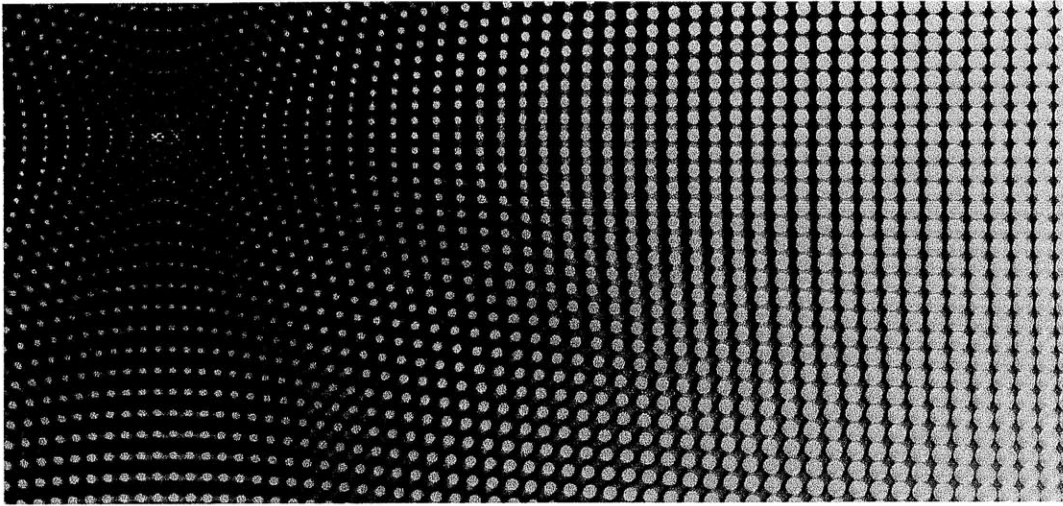


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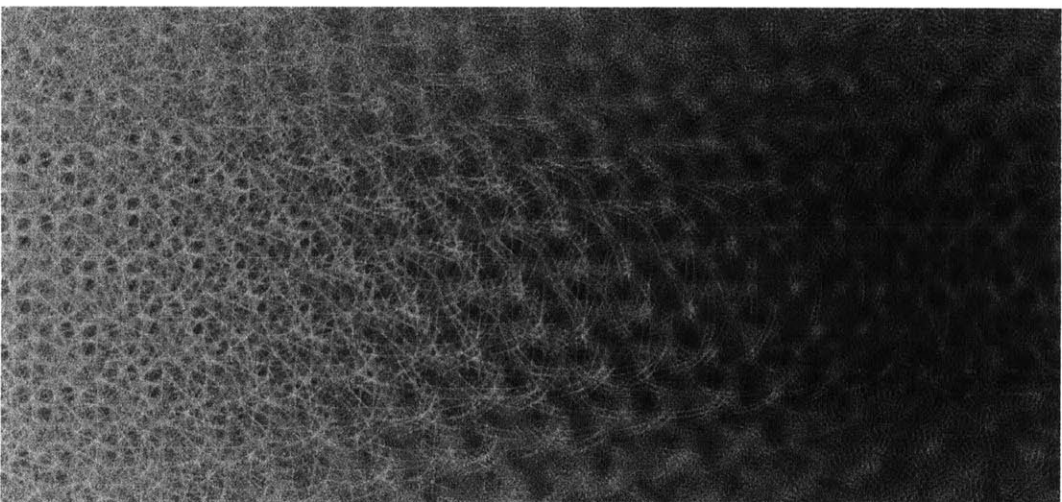
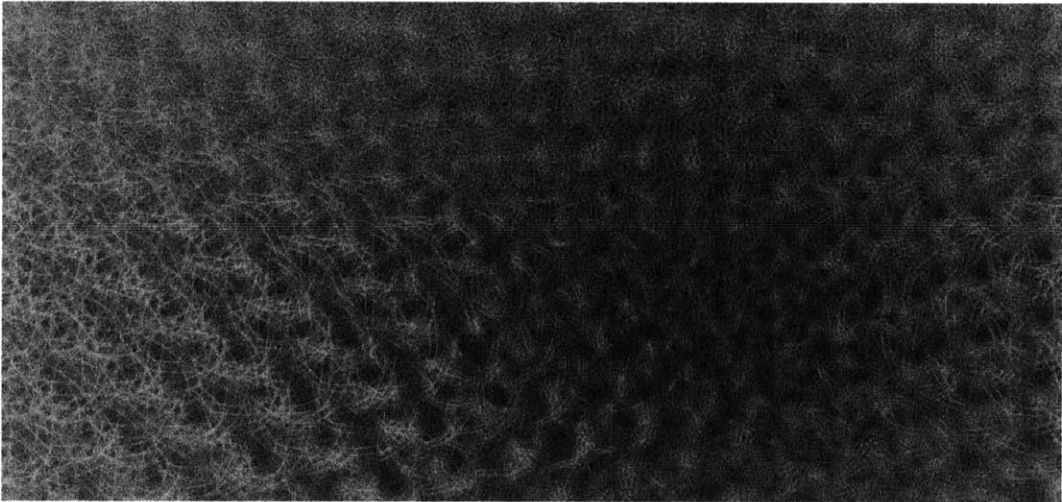
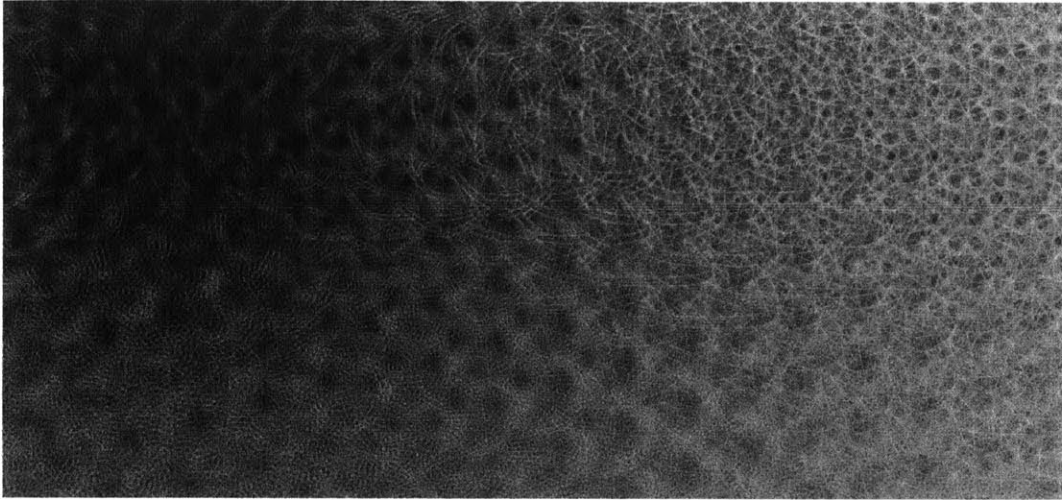


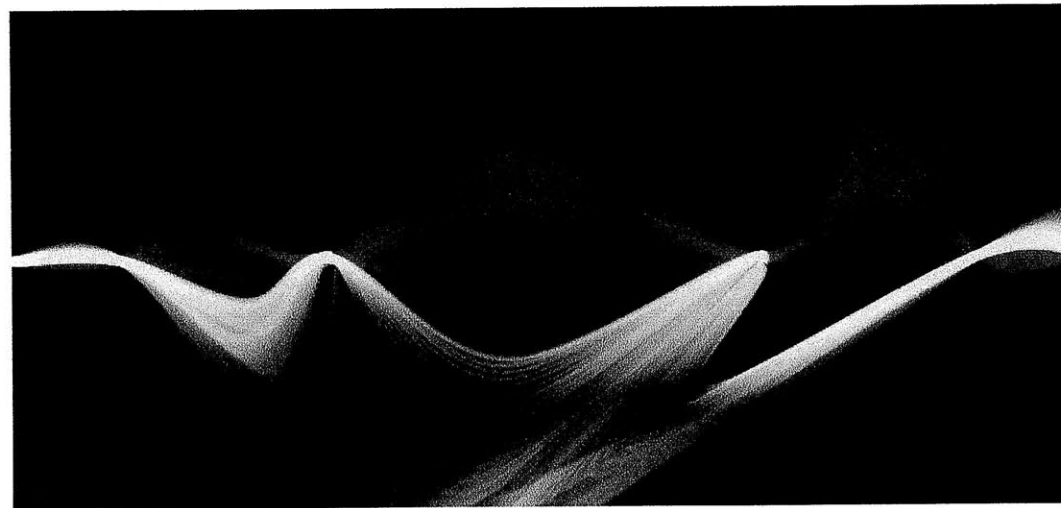
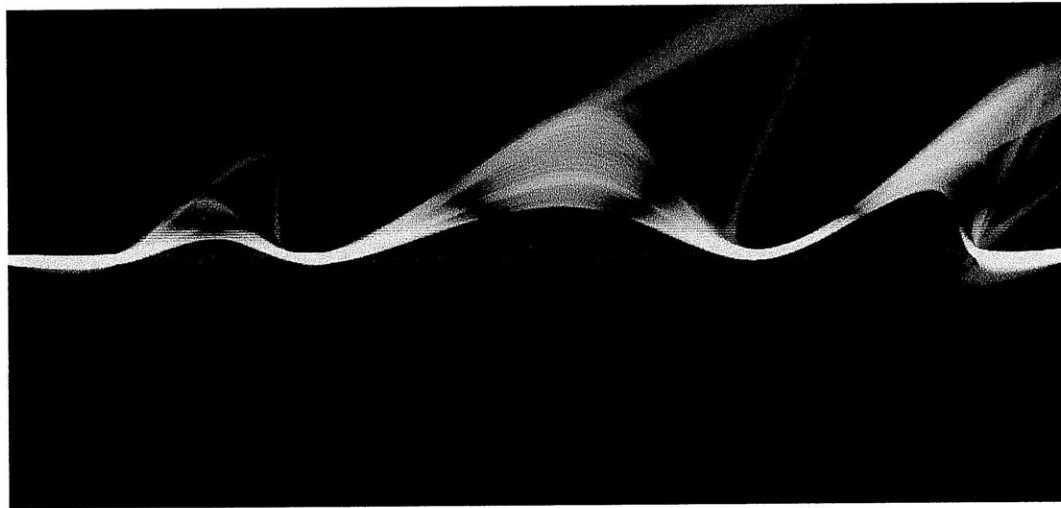
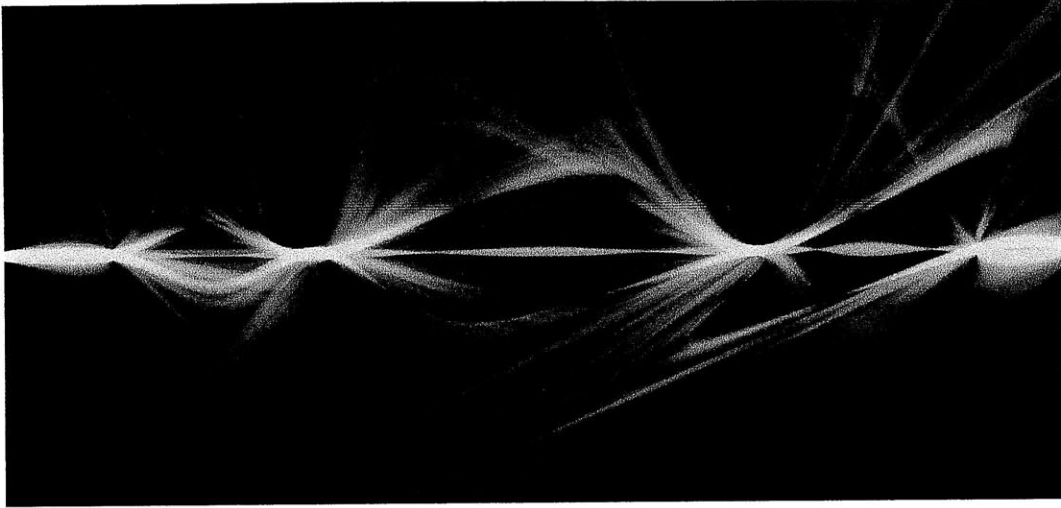
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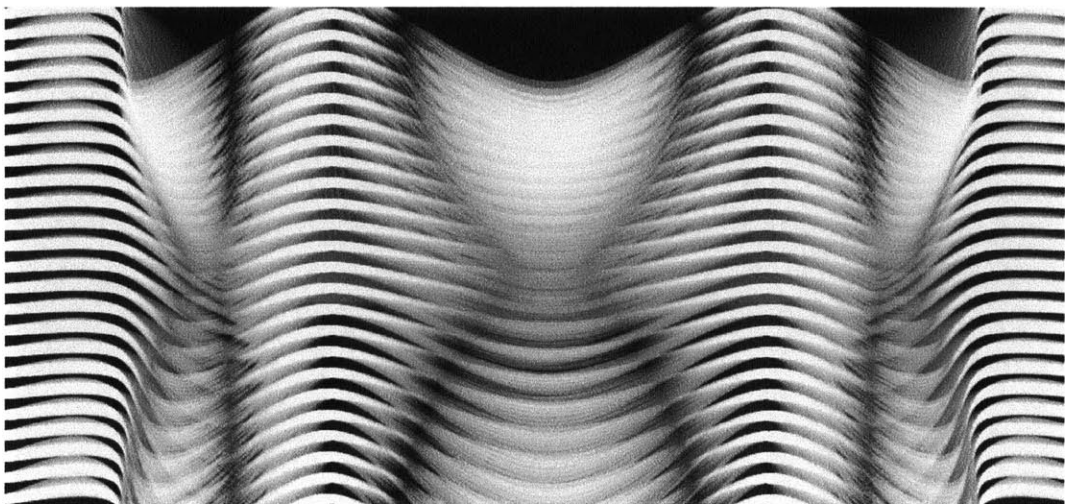
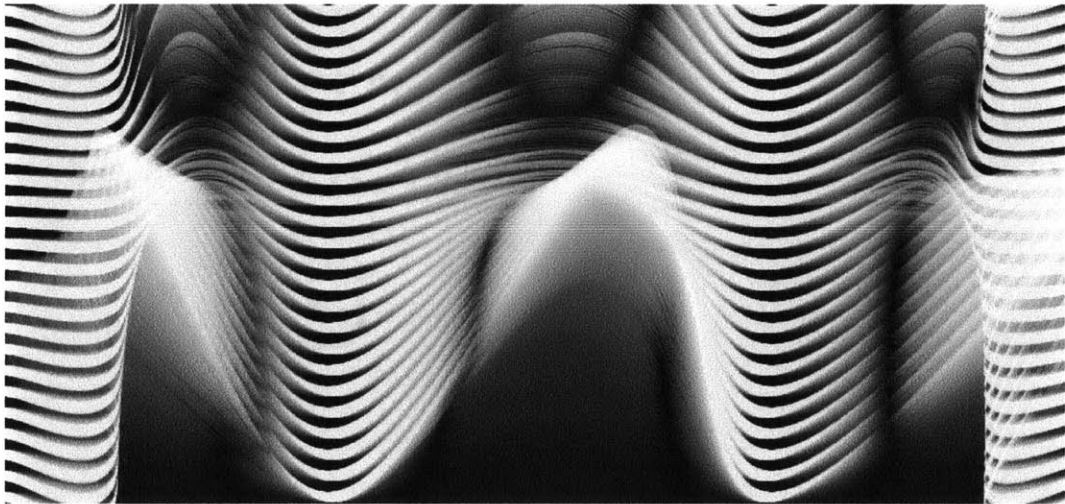
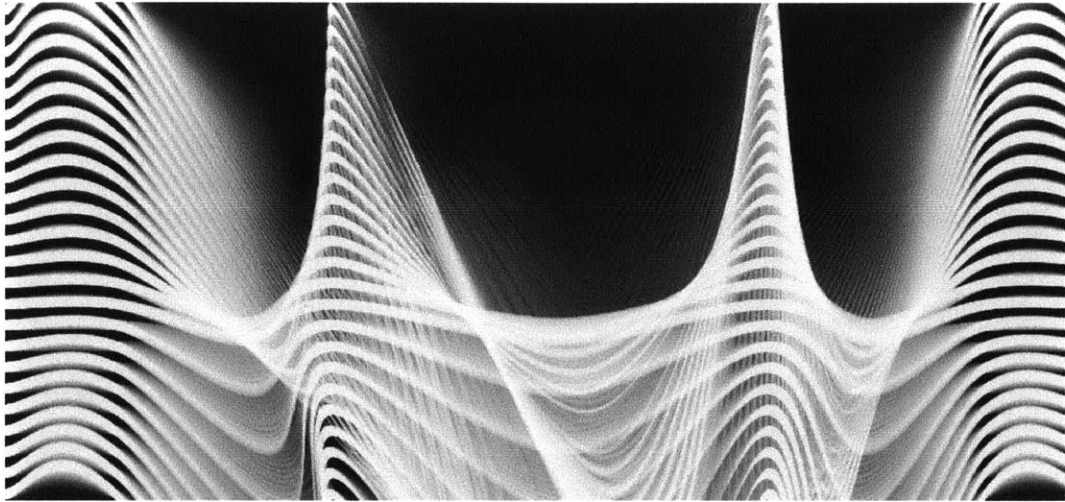


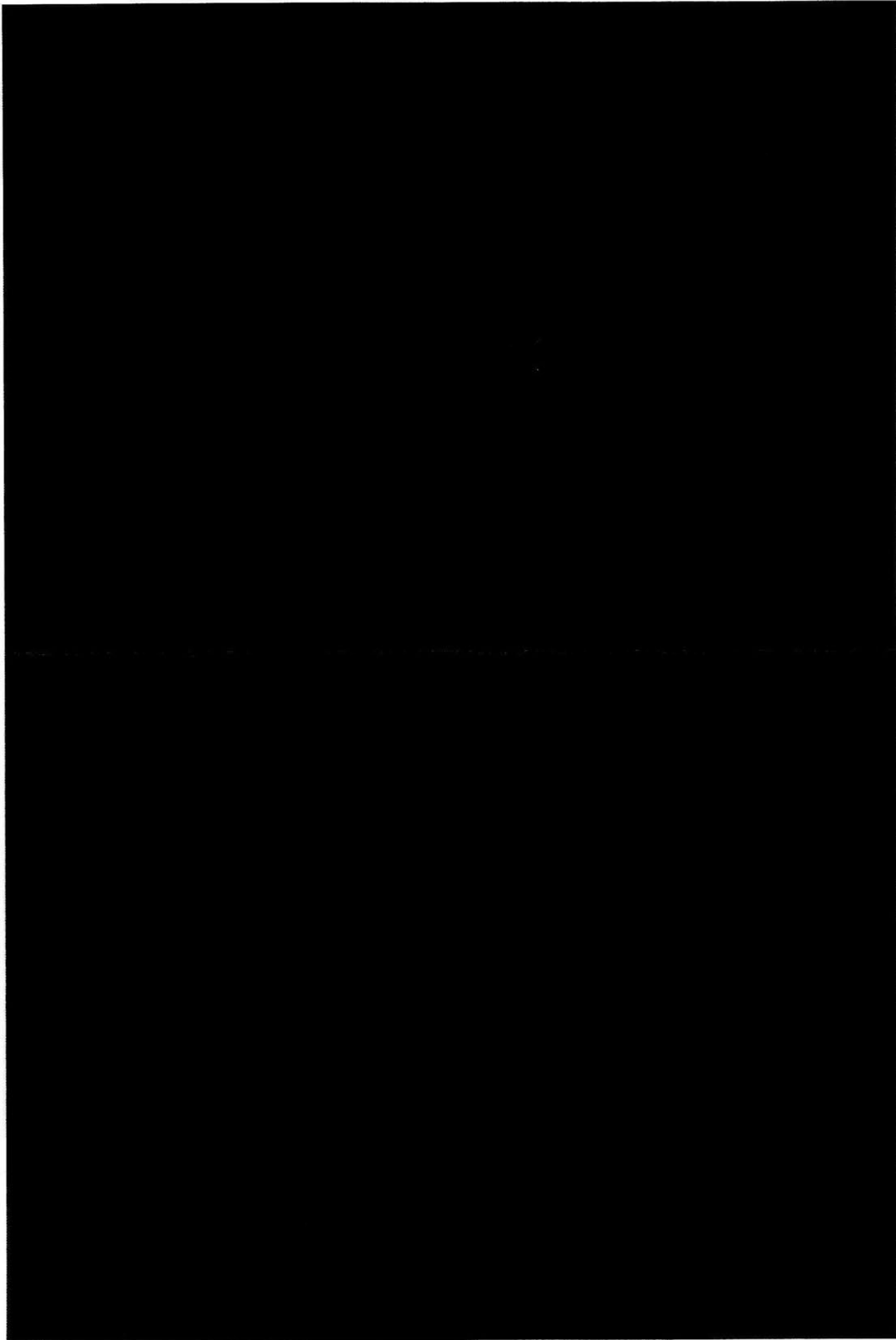


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RepRap

Chapter 04

RepRap .

Rapid Prototyping Machine

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RepRap



Chapter 04

RepRap .

Rapid Prototyping with RepRap

Leslie Lok and Sasa Zivkovic have built the RepRap Prusa Mendel Kit from MakerGear. Information on the "Ford Model T of 3D printers" can be found on the RepRap Wiki (http://reprap.org/wiki/Prusa_Mendel). RepRap will serve as a much needed cheap personal rapid prototyping machine for architectural production. 24/7 3d printing!

RepRap is so exiting because it encourages experimentation with 3d printing. Similar to developing photographs, "exposure times" can be changed, adjustments made, etc. (For example melting times can be prolonged or shortened). The 3d printer becomes more than just an output device, it turns into a design tool. RepRap will be used to visualize and experiment with temporal processes. It will translate some of the processing studies from Milieus and Algorithms into 3d forms.

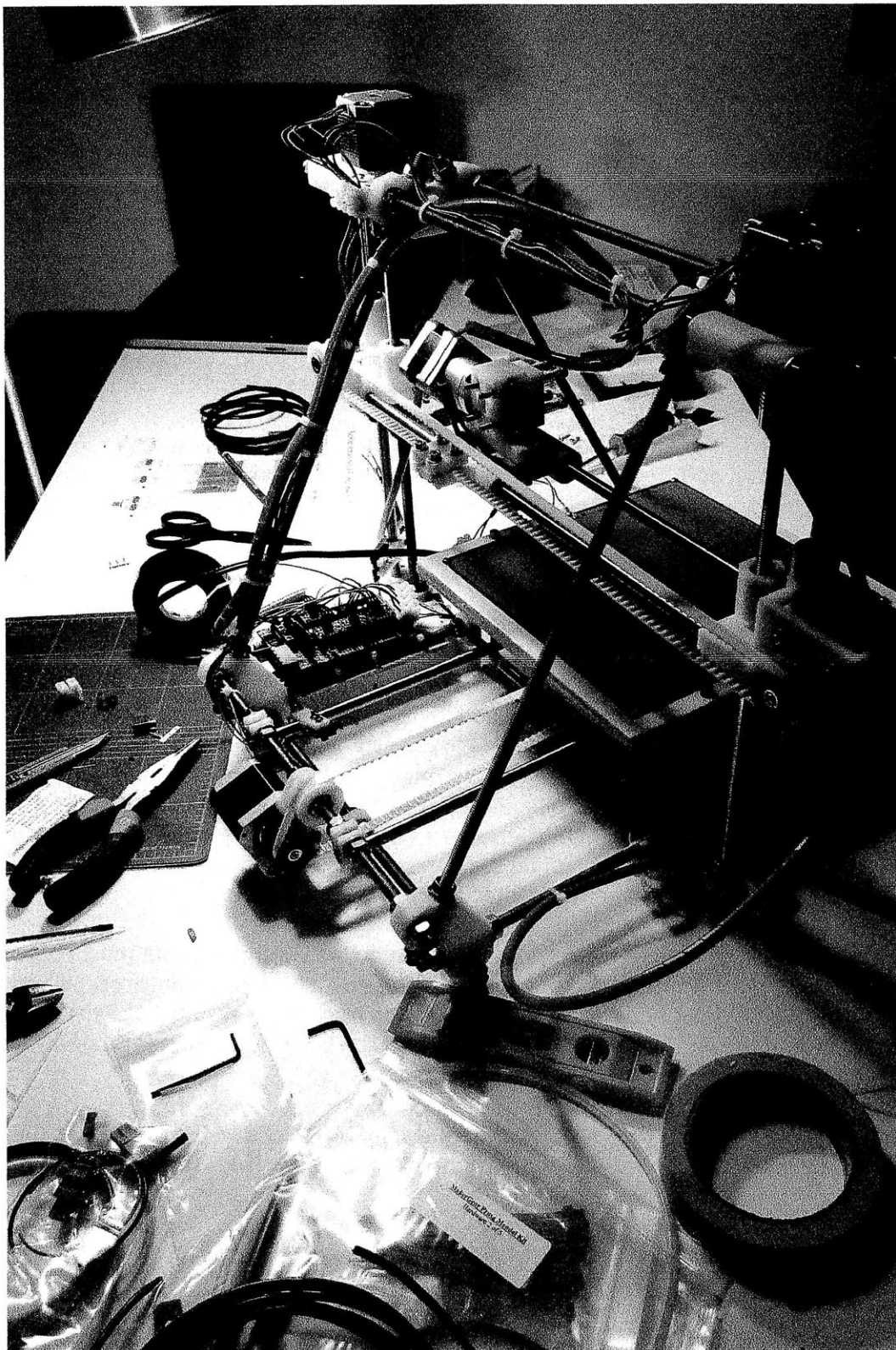
RepRap description from the Wiki:

"RepRap is a free desktop 3D printer capable of printing plastic objects. Since many parts of RepRap are made from plastic and RepRap can print those parts, RepRap is a self-replicating machine - one that anyone can build given time and materials. It also means that - if you've got a RepRap - you can print lots of useful stuff, and you can print another RepRap for a friend... RepRap is about making self-replicating machines, and making them freely available for the benefit of everyone. We are using 3D printing to do this, but if you have other technologies that can copy themselves and that can be made freely available to all, then this is the place for you too.

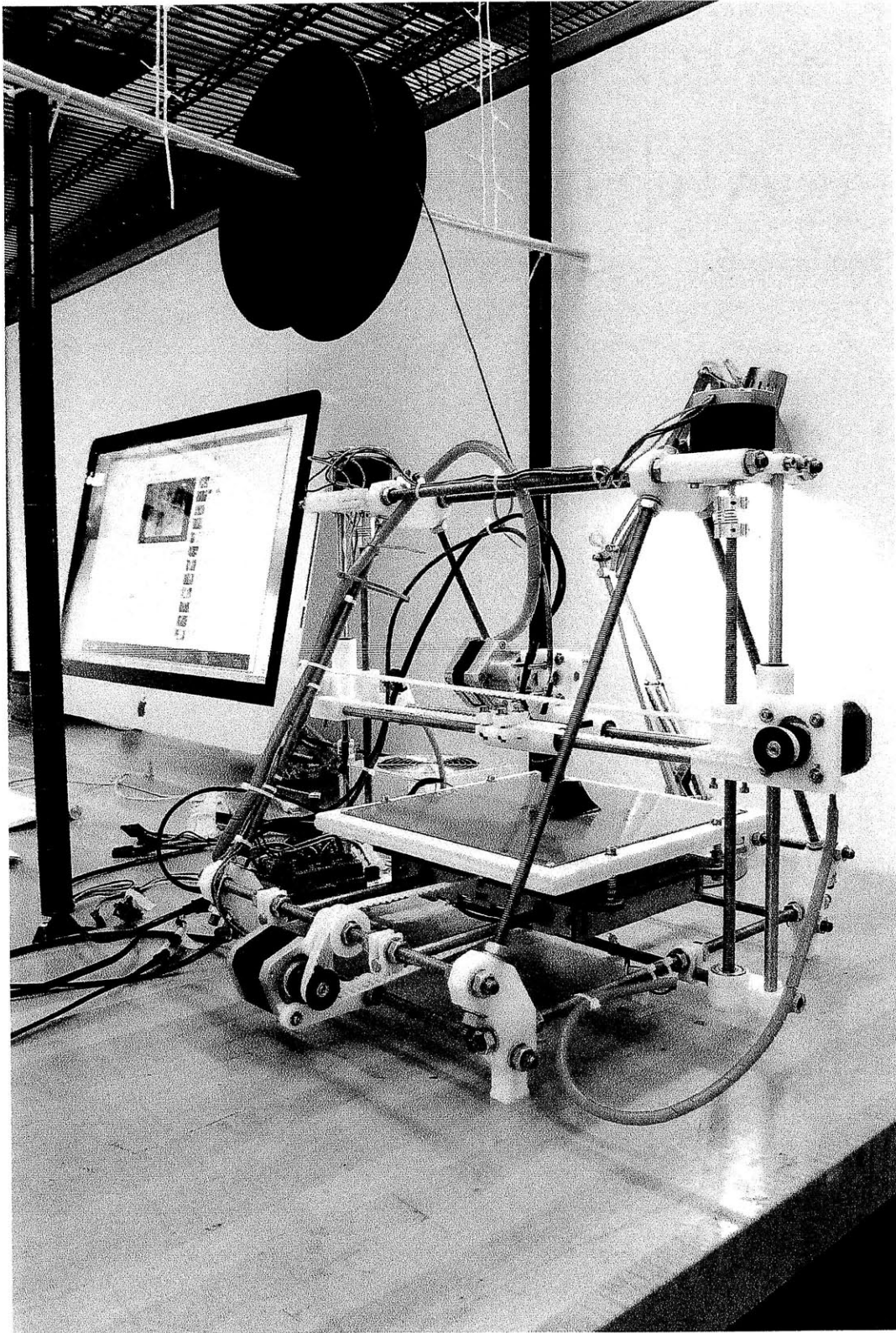
Reprap.org is a community project, which means you are welcome to edit most pages on this site, or better yet, create new pages of your own. Our community portal and New Development pages have more information on how to get involved. Use the links below and on the left to explore the site contents. You'll find some content translated into other languages.

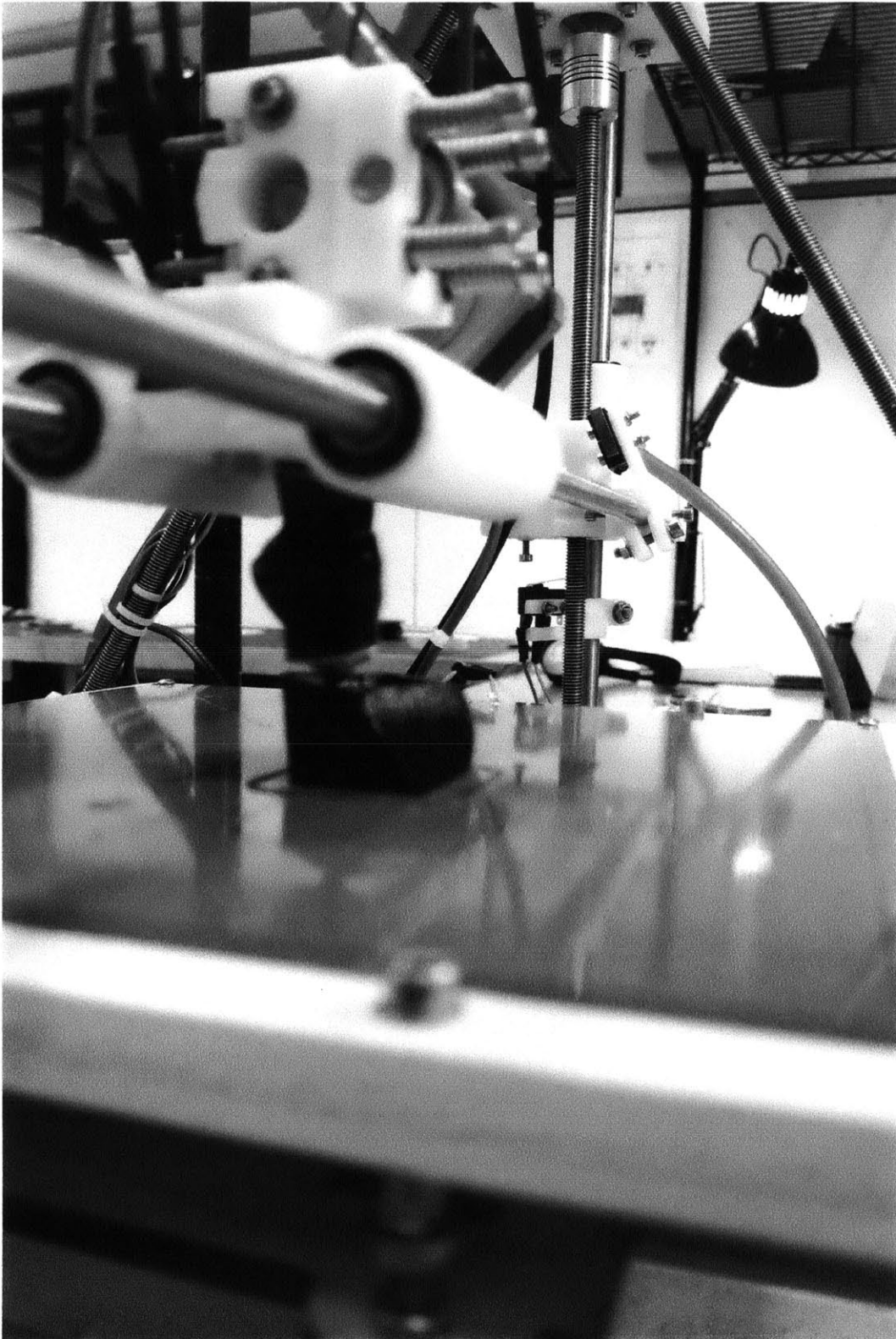
RepRap was the first of the low-cost 3D printers, and the RepRap Project started the open-source 3D printer revolution. [http://reprap.org/wiki/Prusa_Mendel]

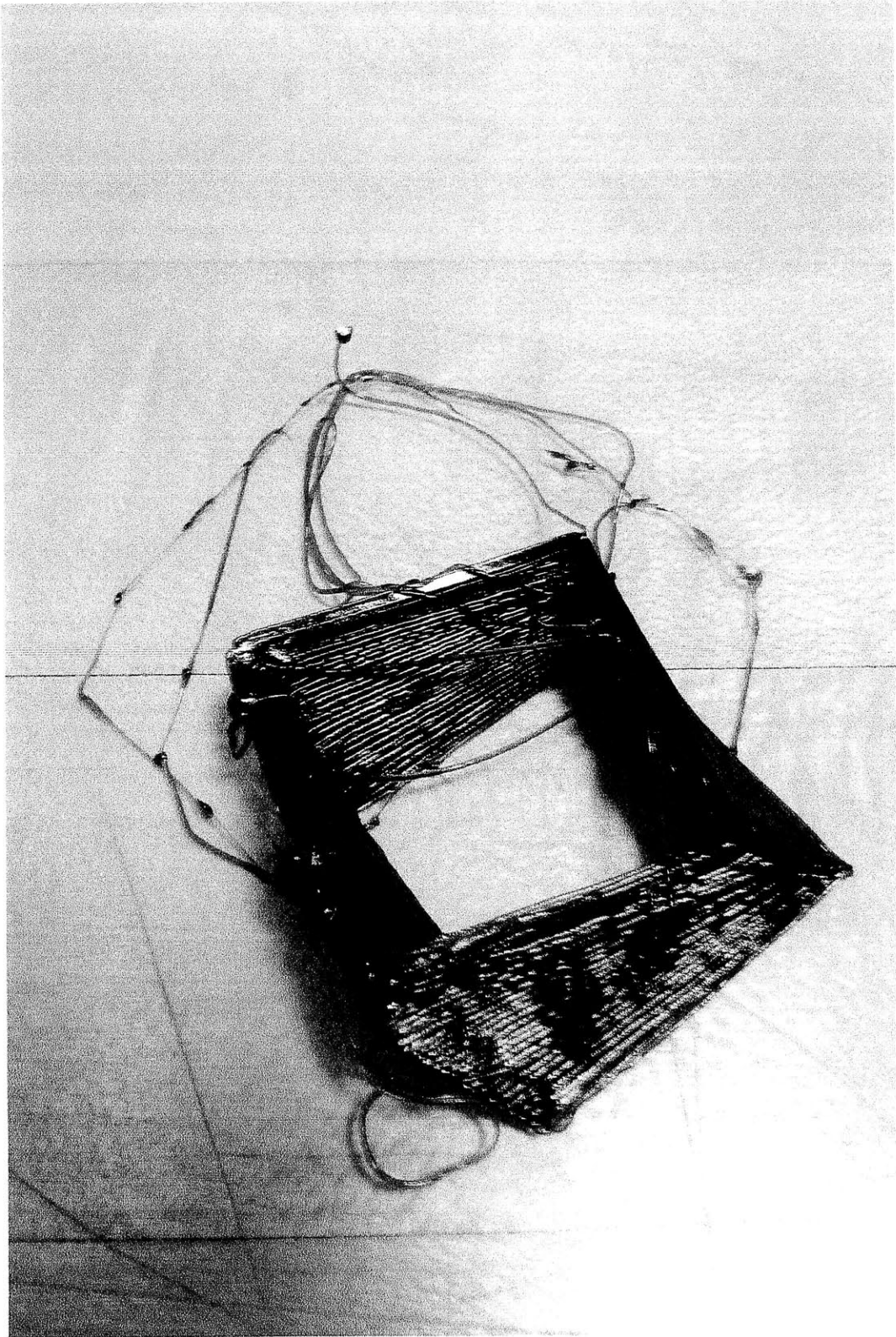
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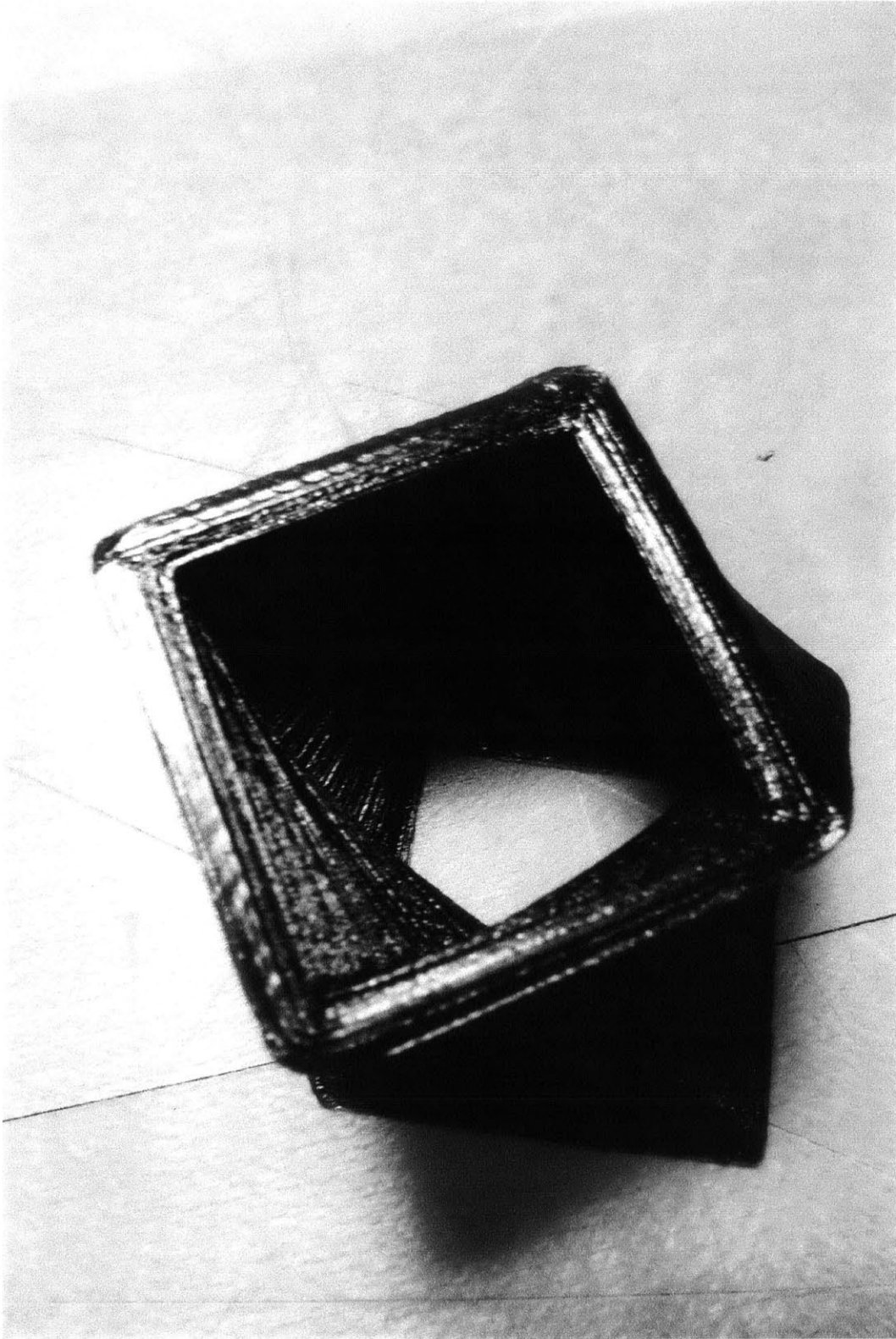








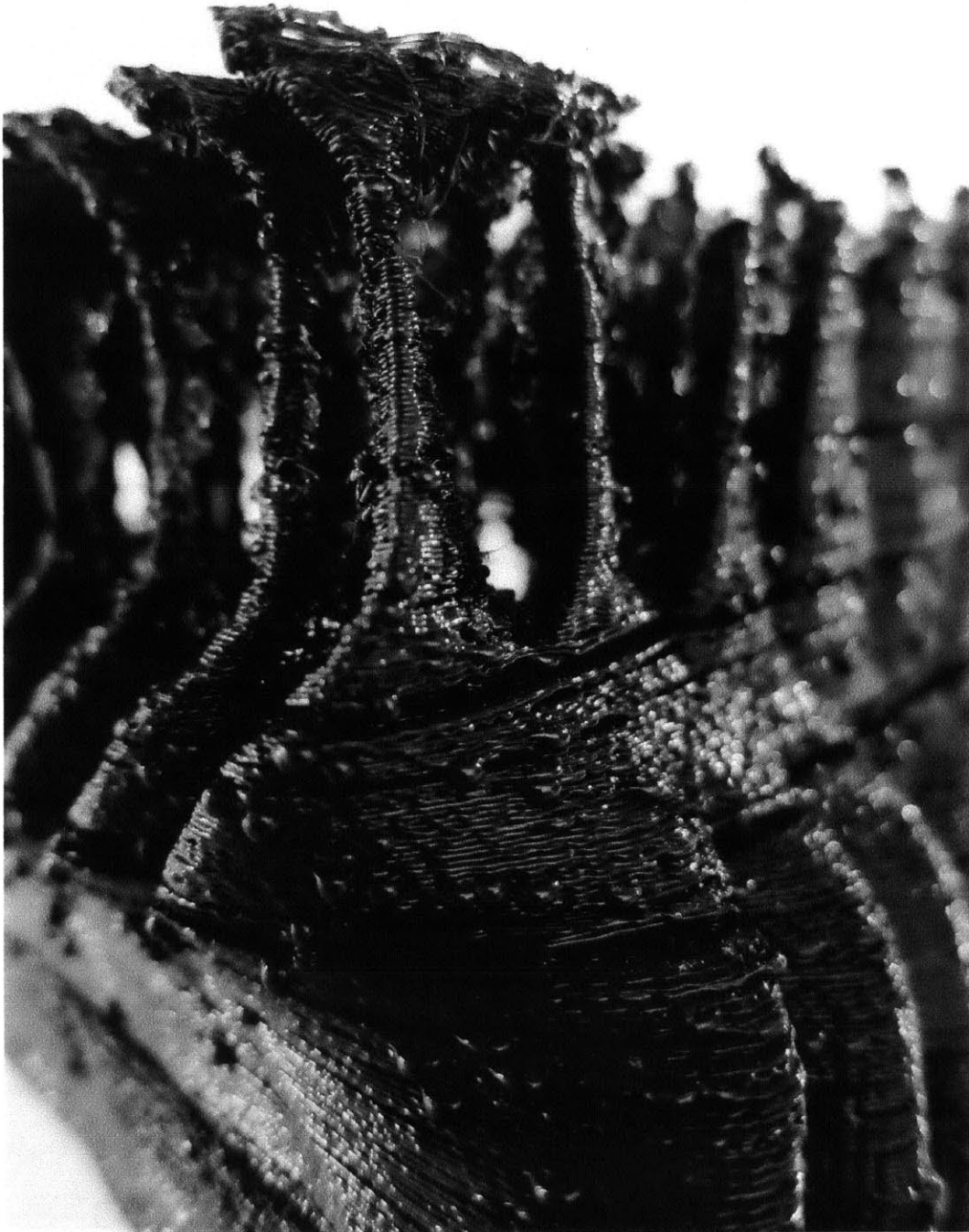
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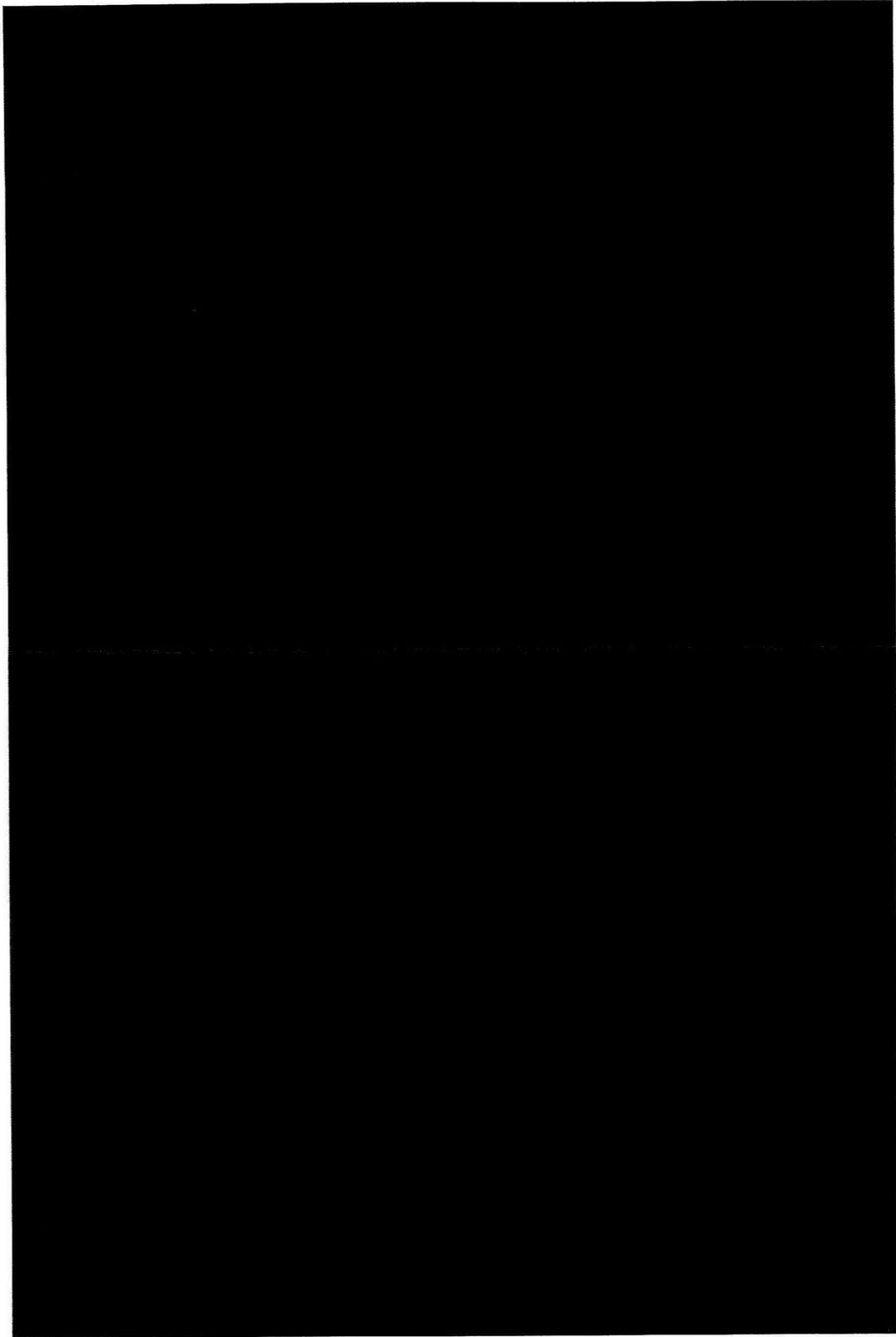


RepRap



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Mushroom Discourse

Chapter 05
Mushroom Discourse
Externalities of the Nuclear Age

Chapter 05

Mushroom Discourse .

Externalities of the Nuclear Age

by

Sasa Zivkovic

ABSTRACT

This paper examines the relationship between large scale energy externalities and their socio-ecologic effects in respect to the 1986 Chernobyl nuclear power plant accident. Through analysis of radionuclide levels in contaminated mushroom populations, correlations between large scale territorial- and small scale ecological externalities can be spatialized and represented. Energy externalities can be studied in relation to an ecological system which allows for both, a horizontal (spatial/political) mapping of the catastrophe as well as a description of vertical (ecological/environmental/social) relationships. This study reveals that ecosystems all across Europe still suffer from radioactive contamination as a result of the Chernobyl fallout. Mushrooms are excellent bio-indicators for nuclear contamination and remain amongst the most vulnerable to radioactivity due to their role as environmental filtering systems.

'Mushroom Discourse' enters a discussion about the role of toxicity, energy, environment, ecology and territory in society by analyzing 137 Cs (Caesium – 137) contaminated mushrooms within a number of local 'dysfunctional' ecosystems, revealing that -even 25 years after the Chernobyl accident- there remain severe large scale territorial effects that reach far beyond the site of the reactor and the Chernobyl Exclusion Zone (CEZ). Contaminated mushrooms define a territory of pollution characterized by mutual radioactive contamination through fallout from the Chernobyl power plant. This "alternate" form of territory spans nation state boundaries, climatic zones as well as geographic differences. Throughout the paper, the mushroom serves as a link for unraveling different scales, spatial relationships and processes surrounding the controversy about nuclear age externalities.

Keywords

wild mushrooms, nuclear energy, nuclear power, radioactivity, radiocesium, contamination, chernobyl disaster, mapping, externalities, territory, ecology

Mushroom Discourse

NUCLEAR ENERGY – UTOPIA’S MYTH

Nuclear energy has long lost its early utopian notions of providing us with a clean and environmentally safe form of power generation. In “Transforming Power: Energy, Environment, and Society in Conflict”, John Byrne and Noah Toly state that, “along with hydropower, nuclear energy has been conceived as a non-fossil technical fix for the conventional energy regime”.ⁱ Today, this statement is by no means obsolete, although reality has proven that – like oil, coal, gas, or hydropower - nuclear energy has severe environmental and social disadvantages.

This paper analyzes nuclear energy in relation to one singular large scale catastrophic event - a direct possible spatial and territorial consequence of nuclear power generation – namely, the reactor catastrophe of Chernobyl. In retrospect, Chernobyl recognizably furthered a de-mystification of nuclear energy and triggered a process of re-thinking the production of energy towards the development of new, “sustainable” forms of energy such as wind, biomass and solar (the new “saviours” and utopias).

Today, the spatial dimension of the Chernobyl disaster has been downplayed and its large scale territorial- and small scale ecological effects have been forgotten. ‘Mushroom Discourse’ enters a discussion about the role of toxicity, energy, environment, ecology and territory in society by analyzing 137 Cs (Caesium – 137) contaminated mushrooms within local ‘dysfunctional’ ecosystems, revealing that -even 25 years after the Chernobyl accident- there remain severe large scale territorial effects that reach far beyond the site of the reactor and the Chernobyl Exclusion Zone (CEZ).

Birth of a myth: the dream of clean, safe, cheap and endless energy

In “Some Persistent Energy Myths” (1982), George Basalla demonstrates that, initially, new forms of energy generation are surrounded by an aura of infinite abundance with yield to potentially utopian effects regarding changes in society.ⁱⁱ Especially the beginning of the atomic age was characterized by euphoria for having found an inexhaustible form of energy generation. Although there have been nonbelievers (for example H.G. Wells, whose novel “The World Set Free” (1914)ⁱⁱⁱ lays out the negative consequences of atomic power), dangers were neglected by most scientists and the public alike.

The history of the atom, radiation and the atomic age is about one century old- if we consider our current understanding of those terms. The existence of “the atom” itself has been a myth for thousands of years, first developed by Greek philosophers at around the first half of 5th century BCE.^{iv} Early deliberations relate directly to the Greek word “atomos” (meaning indivisible): It was envisioned that every substance in the world is composed of small pieces which form matter within a vacuum. The idea of atoms evolved but remained speculative until their scientific discovery at the end of the 18th century.

In 1904 Ernest Rutherford, one of the “fathers” of nuclear science describes the “energy potential” contained within the atom: “If it were ever possible to control at will the rate of disintegration of the radio elements, an enormous amount of energy could be ob-

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Figure 1: Nuclear test at Nevada test site in 1951

Figure 2: "The arrow of time" | Technology utopias flip back on themselves revealing unexpected complexities

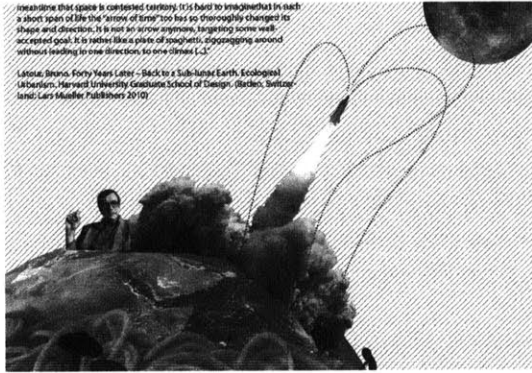


Figure 3: Exploded reactor in 1986 | Key contemporary environmental disaster?



Figure 4: Deserted town of Pripjat | Chernobyl Evacuation Zone | The new post-natural?

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tained from a small amount of matter.”^v One year later, in his Theory of Relativity, Albert Einstein proves that inconceivably large amounts of energy are contained within in small amounts of matter ($E = m \cdot c^2$). The modern myth of nuclear energy abundance was born: The amount of energy contained in the atom’s seemingly insignificant mass holds the premise to cover humanities need for energy at an instance – and indefinitely!

Einstein remains a key figure in the early history of nuclear energy and power. His 1938 letter to President Franklin D. Roosevelt, warning that Nazi Germany could be developing nuclear weapons, is an important catalyst for the establishment of a US nuclear weapons program. The results of the Manhattan Project and its influences and impacts across the world are well known. In the end, H.G. Wells dystopic prediction came true after all.

In fact, the Manhattan Project marks the starting point of the modern Atomic Age. It not only initiated military programs but also fostered the civil use of nuclear energy – a transition from nuclear energy to nuclear power. The Atomic Energy Commission (AEC) was established by Congress in 1946 in order to develop and research concepts of civil use of nuclear energy. The first electricity generated in a US nuclear power plant was in an Experimental Breeder Reactor in Idaho in 1951. The first commercial reactor in the US was located in Shippingport, Pennsylvania.

In the 1960’s, commercial use of nuclear energy grows rapidly: “Utility companies saw this new form of electricity production as economical, environmentally clean, and safe.”^{vi} Following the first initial boom was a period of stagnation, due to overlooked problems with nuclear power such as reactor safety, deposition of radioactive waste and other environmental considerations: “By the early 1970’s [...], many had become disillusioned with nuclear energy, divested it of its myths, and came to regard it as an enemy of all life on earth.”^{vii} It became clear that there is a price to pay for the use of nuclear energy which is in fact equally severe (or even more so) as in other, older forms of energy such as coal, gas and oil.

Nuclear disaster: utopia’s price tag

The first documented major accident in the history of nuclear power occurs in 1979 at the Three Mile Island plant in the United States. The accident had severe impacts on the nuclear industry^{viii} and further disillusioned the nuclear myth. Expansion of nuclear power came to a hold:^{ix} In 1979 orders for new power plants were cancelled due to negative press and media, and a lack of legislative clarity from government officials.^x The Three Mile accident revealed the dangers of nuclear power and it erased remaining utopian fantasies associated with its commercial use. The report “50 Years of Nuclear Energy” by the International Atomic Energy Agency (IAEA) states that “the psychological effect [of the Three Mile accident] on the population in the neighborhood, and eventually throughout the Western world, was immense.”^{xi}

By the mid 1970’s, global environmental conscience emerges in many countries resulting in new environmental legislation, ministries of environment and the founding of green

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parties^{xii}. Bruno Latour describes this as the moment in history in which the “arrow of time” points from an overarching technological project (Latour refers to the Apollo missions) to something which “is not an arrow anymore, targeting a well accepted goal. It is rather like a plate of spaghetti, zigzagging around without leading in one direction, to one climax [...]”^{xiii} In this sense, the history of the space age is analogous to the history of nuclear energy. Interest shifts from nuclear energy utopias to health concerns of people living in the vicinity of power plants, the effects of excess heat water on river ecosystems, adequate locations for storing nuclear waste, or in case of this study, the implications of 137 CS mushroom contamination in forests ecosystems across Europe.

The Chernobyl accident in April 1986 -one of the key contemporary environmental disasters- had a significant impact on environmental movements all around the globe. It shaped a whole generation’s perception of nuclear energy and proved those right who, all the years before, warned of the incalculable risks of nuclear technology. In the direct aftermath of the catastrophe, new construction of nuclear power plants was stopped in North America and Europe. In most other countries, however, construction of new reactors continued and soon after the catastrophe the nuclear energy business was “back to normal” all across the world. Chernobyl, as tragic as it might have been for the people affected (the accident was spatially downplayed to a small, local scale 30km around the site of the reactor), was regarded as a singularity, an event to occur only due to the lack of safety standards in the former USSR. The US Department of Energy notes in its brochure on the History of Nuclear Power: “The reactor [in Chernobyl] has an inadequate containment building, and large amounts of radiation escape[d]. A plant of such design would not be licensed in the United States.”^{xiv} (Hence, according to the Department of Energy, a reactor catastrophe in the US can be ruled out.)

The reactor catastrophe in Fukushima in March 2011 tragically proves that nuclear energy production cannot preclude catastrophic failure. In “Toxic Discourse”, Lawrence Buell refers to Charles Perrow and what Perrow describes as “normal accidents”: In scenarios with high complexity and “tight coupling” of processes, accidents have to be expected – often rather sooner than later. ^{xv} Therefore, normally, reactor meltdowns occur about every 25 years.

The accident in Fukushima has led to a re-evaluation of nuclear power in a number of countries. Germany’s pro- nuclear government, for example, (strongly influenced by media and the public) did an about-turn in energy politics in the spring of 2011 and is now advocating for phasing out nuclear power by the year 2021.^{xvi} The argument that nuclear catastrophe could only occur in a country with desolate safety standards seems obsolete. Nevertheless, as of 2011, the United States Nuclear Regulatory Commission (U.S.NRC) has active applications for over 28 new nuclear reactors^{xvii} all across the United States. Globally, nuclear power capacity is expected to double by the year 2030.

CHERNOBYL CATASTROPHE

The reactor catastrophe of Chernobyl had a vast impact on areas in direct vicinity to the

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power plant as well as it affected large territories in Europe. The fallout cloud contaminated forests, agricultural land, settlements and cities across a whole continent. Radiation levels varied strongly, depending on local influences such as rainfall, topography or type of soil. The released radioactivity was approximately 500 times that of Hiroshima after the first deployed nuclear bomb in history destroyed the entire city.^{xviii}

Time-line of a disaster: the story of reactor block IV

The Chernobyl accident occurred on April 26, 1986 at around 1:24 am in reactor block number IV of the Chernobyl power plant. The reactor cooling system has been turned off due to a security test (the experiment was supposed to simulate a fatal incident). The shutdown of cooling capacity resulted in an uncontrollable chain reaction, culminating in a series of steam explosions within the reactor itself.^{xix} The reactor and its emergency systems (especially its cooling mechanism) were completely destroyed by the explosions. The consequent reactor fire lasted for ten days. It is estimated that about 3.0% of the total reactor content were released into the atmosphere.^{xx}

The city of Pripyat with its 45000 inhabitants was evacuated on April 27, one day after the incident occurred. It was decided to evacuate people and cattle from an area of 30 km around the reactor on May 2 and within four days after the accident, the Chernobyl Evacuation Zone (CEZ), still existing today, was established. Overall it is estimated that about 350000 people in the most affected countries Ukraine, Belarus and Russia had to be evacuated due to radioactive contamination of the environment.^{xxi} Today, five million people continue to live in areas affected by radioactive contamination, coping with the social, environmental, health and economic consequences. ^{xxii}

About 240,000 so called "liquidators" were involved in mitigation activities within the most contaminated areas and directly on site at the power plant.^{xxiii} According to the International Committee on Radiological Protection, more than 4600 thyroid cancer cases related to radioactive contamination have been reported in Belarus, Ukraine and Russia.^{xxiv} Other reports estimate the total number of cancers and casualties with 15,400 (US Academy of Sciences) or up to 76,000 (J. Gofman).^{xxv} It should be mentioned that expert numbers and opinions vary drastically on almost any subject related to the accident. This might partially be explained by political motivation – Chernobyl as an environmental disaster has always been politicized by lobbyists, environmentalists and governments in various ways. On the other hand, due to the mere complexity of the problem, there remains a general "uncertainty" surrounding the discussion as data is either missing or subject to interpretation.

Continental traces: meteorology in April and May 1986

First traces of the explosion in reactor number IV of the Chernobyl power plant outside the USSR were found on April 28 in the clothing of a technician at the Forsmark nuclear power plant in Sweden.^{xxvi} Due to the alarmingly high levels of radiation it was first suspected that leakage had occurred within the reactor in Forsmark itself. Later that day, the same distressing signals came from reactors and control stations in Norway, Finland and Denmark. At this point, Sweden confirmed that the source of radiation had to be

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Figure 5: Calculated fallout cloud from April 26 until May 4 1986 | Larger map attached at the end of the paper

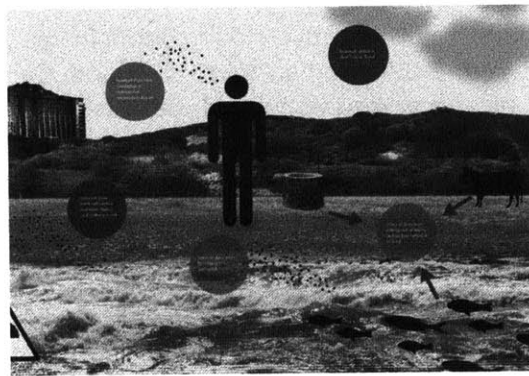
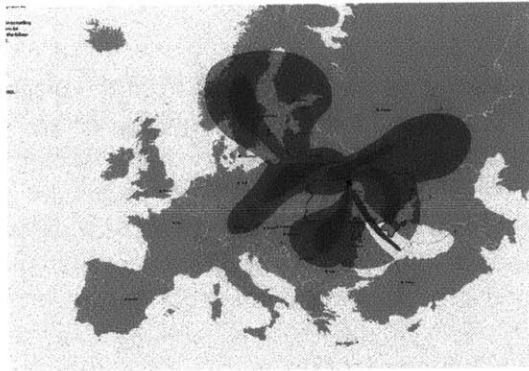


Figure 6: Diagram of different types of radioactive contamination and human radiation intake | Larger drawing attached at the end of the paper

Figure 7: Local nuclear externalities | liquidators removing the highly contaminated remains of the reactor explosion

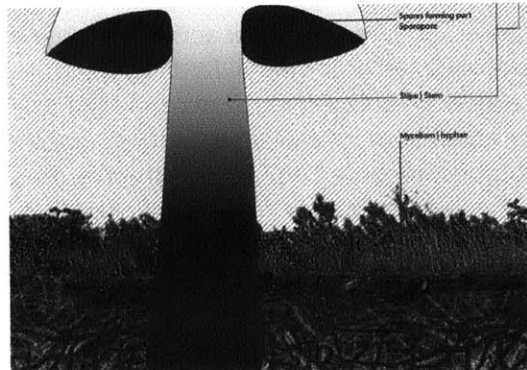


Figure 8: Mushroom and mycologic terms | Expansive mycelium net filters nutrients – and pollution

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outside the country.

The prevailing winds in those days transported air from the Black Sea, across Ukraine, over the Baltic and into Scandinavia. It was though suspected that there must have been a severe nuclear incident within the borders of the former USSR. It took the soviet officials six hours to respond to urgent requests about the source of radioactive contamination. At 9:00pm local time, a telecaster on Moscow television read an official statement from the Council of Ministers: "An accident has taken place at the Chernobyl power station, and one of the reactors was damaged. Measures are being taken to eliminate the consequences of the accident. Those affected by it are being given assistance. A government commission has been set up." xxvii

In the following eight days, the radioactive cloud contaminates vast areas of Europe. It first crosses Scandinavia and Britain, then parts of Poland, Czechoslovakia, Bavaria, Austria and North Italy. After that it turns towards Belarus and Russia before it finally contaminates large areas in Ukraine, Romania and Hungary. The radioactive cloud carried large quantities of different radionuclides, most importantly Iodine 131, Cesium 134 and Cesium 137. xxviii As far as Japan and the US, relatively high concentrations of radionuclides were measured. xxix

The so called "fallout", a combination of a passing radioactive cloud with local rainfall led to uneven contamination in affected regions. Both, the varying levels of radioactive concentration within the cloud as well as local environmental conditions influenced ground contamination. Overall, contamination occurred quite unpredictably but, "especially in areas where rain fell while the radioactive cloud was passing, pollution by Cs-137 was remarkable." xxx

The Chernobyl accident – seen isolated as a singularity - spatially exceeded any other man made environmental disaster in scale. Yet, it should be mentioned that Chernobyl is one of the few environmental disasters that, due to its very specific type of contamination, can be easily measured, monitored and assessed as a singularity at all. Theoretically, every externality which pollutes the air should produce similar effects.

FALLOUT TERRITORY - FALLOUT EXTERNALITIES

Ecosystems all across Europe suffered from radioactive contamination in the Chernobyl fallout cloud. Due to their role as environmental filtering systems, forest ecosystems are amongst the most vulnerable to radioactivity: "Following the Chernobyl accident, vegetation and animals in forests and mountain areas showed a particularly high uptake of radiocaesium, with the highest recorded 137 Cs activity concentrations being found in forest products, due to the persistent recycling of radiocaesium in forest ecosystems. Particularly high 137 Cs activity concentrations have been found in mushrooms, berries and game, and these high levels have persisted since the accident." xxxi

Measuring contamination – nuclear externalities

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A certain amount of background radiation on earth is natural and part of the environment. Natural background radiation averages about 2.4 mSv per year and the typical range for background radiation lies between 1 – 10 mSv per year which includes both, cosmic- as well as terrestrial radiation.^{xxxii} Radiation is measured in Millisieverts (mSv) - a standard unit of measurement developed by Swedish medical physicist Rolf Maximilian Sievert - in order to quantify a dose of equivalent radiation that allows for evaluation of biological effects of radiation on living things.^{xxxiii} The IAEA guideline and dose limit for radiation from any man made facility is 1 mSv per year. (reference values: chest CT scan: 6–18 mSv per scan / New York-Tokyo flights for airline crew over one year: 9 mSv).^{xxxiv} Evaluating radioactive contamination is complex because all measurements include a temporal component which effectively determines the radiation hazard for living organisms. In other words, short exposure to a high dose of radiation might be less harmful than low exposure over a longer period of time.

Radioactivity in relation to foodstuffs is usually measured in Bequerel (Bq). One Bequerel is the “quantity of radioactive material in which one nucleus decays per second”.^{xxxv} 80,000 Bq ¹³⁷Cs equal about 1 Millisievert (mSv)^{xxxvi} and living on land which is contaminated with 1,480 kBq/m² is equal to a dose of 5 mSv per year. The guidelines for a relocation of people after the Chernobyl accident were radiation doses which exceed 350 mSv for an average human lifetime. (Other than people, ecosystems are harder to relocate and the IAEA states that: “At the time of the accident, the philosophy of radiation protection of non-human species had not been sufficiently developed to be practically applied for the purposes of justifying appropriate countermeasures. Such policies are currently still under development.”^{xxxvii})

Energy externalities in relation to the Chernobyl catastrophe are often controversial and depend strongly on the interpretation of radiation data and measurements. Pavel Kalac, for example, describes that the usual radiation limit for foodstuffs used to be 600 Bq per kg of fresh weight prior to 1986 in most European states. In response to the Chernobyl disaster, the limit for foodstuffs such as mushrooms got raised to 1,250 Bq per kg of fresh weight.^{xxxviii} The IAEA describes the urge for changes in regulations with “the scale and long term effects of the Chernobyl accident requir[ing] the development of some additional national and international radiation safety standards as a result of changing radiological conditions.”^{xxxix}

Mushroom territory - mushroom externalities

In Economics, externalities are defined as the price for social, environmental and economic effects (either positive or negative) in relation to sites of production.^{xl} In his essay, “The Territorial Organization and the Space-Technology Nexus”, geographer Erik Swyngedouw expands on the notion of externalities, by adding a territorial (spatial) dimension to the definition: “The collective effects associated with territorial organization, and embedded in the territorial nature of circulation, are usually defined as externalities [...]”^{xli}

Chernobyl is such a circulatory and territorial externality: it establishes large scale spa-

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tial relationships based on the logic of pollution and circulation. In "Risk Society", Ulrich Beck states that "whereas poverty is hierarchic, smog is democratic"^{xlii} – in this sense, the Chernobyl fallout cloud has created a truly democratic territory. It erased notions of nationality, politics and economy – its externalities are international.

MUSHROOM ECOLOGY – VERTICAL CONTAMINATION

"At present, in most of the settlements subjected to radioactive contamination, the air dose rate above solid surfaces has returned to the pre-accident background level"^{xliii} Nevertheless, contamination of soil and certain forest ecosystems remains a problem all across Europe. While in some areas there have been studies conducted on the effects of radiation (agriculture and farming), the role of fungus contamination within forest ecosystems needs further examination – as stated in the goals of the IAEA Chernobyl Forum: "[Goals are: to] determine mechanisms of radionuclide behavior in less studied ecosystems (e.g. the role of fungi in forests) in order to understand the mechanisms determining the persistence of radionuclides in these ecosystems and to explore possibilities for remediation."^{xliv}

Mushroom filters

Mushrooms are the fleshy spore bodies of fungi and form their own kingdom of eukaryotic organisms. They are neither plants, animals, nor bacteria. Fungi occur in almost every environment on Earth and play an important role in balancing ecosystems. Along with other organisms such as bacteria, fungi play a critical role in decomposing organic matter and additionally play an essential role in nutrient cycling.^{xlv}

Mushrooms are excellent bio indicators for polluted ecosystems^{xlvi} because they filter the soil in search for mineral nutrients.^{xlvii} This behavior places them amongst the most vulnerable to radiation of all organisms: "The highest levels of contamination [in relation to the Chernobyl disaster] have been observed in mushrooms due to their great capacity to accumulate some mineral nutrients as well as radiocaesium."^{xlviii} Due to its large body of spores in the ground, the mushroom easily takes up ¹³⁷Cs and concentrates it within its fruiting body. It can be scientifically proven that in examined mushroom species across Europe, 80% of the contamination with ¹³⁷Cs originated from the Chernobyl catastrophe. The other 20% contamination with ¹³⁷Cs result from nuclear weapons testing prior to 1963.^{xlix}

Based on assessing contamination in mushrooms, the effects of nuclear externalities on local ecosystems can be estimated: Mycorrhizal fungi, the type of fungi which live in symbiosis with other organisms at the root level, absorb especially large quantities of ¹³⁷Cs.^l The contamination of mushrooms has led to warnings about the edibility of wild mushrooms in many affected countries. In Germany, it is not recommended to consume more than 250g of wild forest mushrooms a week in order to prevent potentially severe health effects.^{li} Other than wild mushrooms, the contamination of cultivated mushrooms is described as negligible.

Mushroom Discourse

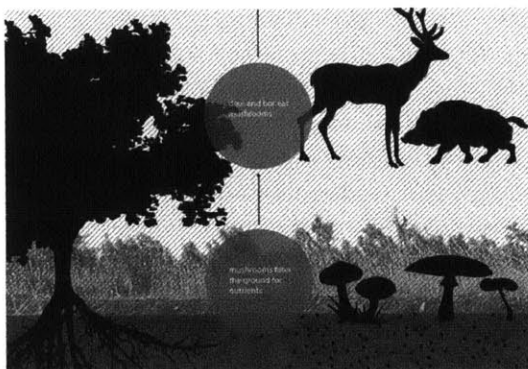


Figure 9: Mushroom food chain (simplified) | Socio-ecological consequences

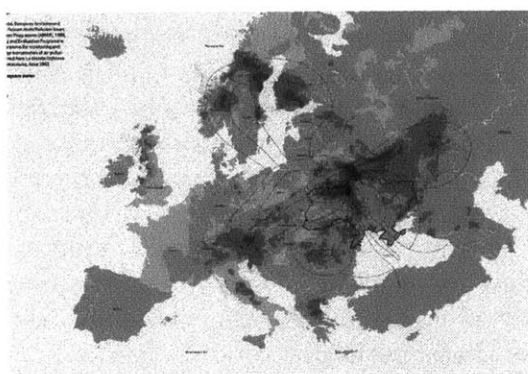


Figure 10: Map of soil contamination levels across Europe | Larger map attached at the end of the paper

Figure 11: Map of mushroom contamination levels across Europe | Larger map attached at the end of the paper

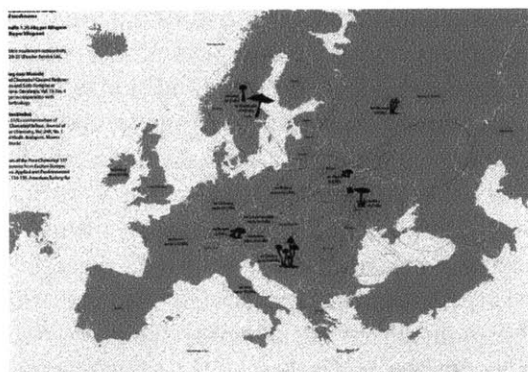


Figure 12: Boar in the CEZ | animals "are not afraid of people because of long term hunt prohibition"



Mushroom Discourse

Fungi form large scale territorial organisms and are comprised in all types of soil across Europe. Their “diffuse mycelial growth [...] in soil suggests that these species may act as extensive nets, obtaining nutrients directly from the soil.”^{lii} Because mushrooms can be found in every part of Europe, they hold the potential to map and represent externalities of the Chernobyl catastrophe in new ways. By analyzing mushroom contamination in Europe, the Chernobyl catastrophe can be re-mapped through physical externalities. Energy externalities can be studied in relation to an ecological system which allows for both, a horizontal (spatial) mapping of the catastrophe as well as a description of vertical (food chain: ecological) relationships.

Mushroom ecosystems

Many species in forest ecosystems depend on mushrooms as food source. Especially wild boar, roe deer, moose and reindeer, but also domestic animals such as sheep and cattle eat mushrooms due to their high nutritious value.^{liii} Mushrooms are at the low end of the food chain, which makes their excessive intake and filtration of radionuclides even more problematic as every animal that eats mushrooms gets disproportionately contaminated with ¹³⁷Cs. For domestic animals, mushroom intake can be controlled and the IAEA states that “management regimes have been modified for some animals in contaminated areas; for example slaughter times are modified to ensure that the ¹³⁷Cs activity concentrations are relatively low.”^{liv} The same accounts for the reindeer of the Sami people in parts of Russia and Sweden whose reindeer herds still suffer high contamination from the Chernobyl fallout.

Human radiation intake originates from eating contaminated deer as well as contaminated forest mushrooms. Throughout Europe, wild edible mushrooms are served as a delicacy. In fact, “Mushrooms provide a common and significant food source in many of the affected countries, particularly in countries of the former USSR.”^{lv} This results in internal radioactive contamination through foodstuffs, especially for people who depend on hunting wild deer and collecting wild mushrooms as a natural means of food acquisition. Countermeasures (hunting or collection bans) are often ineffective in such cases: When people depend on wild foodstuffs as part of their daily diet “such restrictions can result in negative social consequences, and advice from the authorities to the general public may be ignored as a result.”^{lvi} Social externalities are part of the consequences of vertical contamination processes through ¹³⁷Cs contaminated mushrooms in the food chain.

Across Europe, radiation levels within mushroom populations vary widely. Figure 11 suggests that the fallout cloud during the first days of the reactor fire and contamination levels in mushrooms correlate. Typical ¹³⁷Cs contamination across Europe ranges from 1.6 kBq/kg in Moscow^{lvii}, 6.2 kBq/kg in Ireland, 18.8 kBq/kg in Croatia^{lviii} and up to 119.5 kBq/kg in Sweden^{lix}. Yet, these values do only represent the small local ecosystems where mushrooms were collected for examination. Contamination levels can vary strongly within short local ranges.

MUSHROOM TERRITORY – HORIZONTAL CONTAMINATION

Mushroom Discourse

Looking through the lens of mushroom contamination caused by the Chernobyl accident can inform an alternate way of examining categories of territoriality. The 'democratic territory of pollution'^{ix} neglects boundaries of the nation state as it is based purely on environmental factors such as weather patterns and fallout conditions, or geological factors such as soil consistency or rock formations. It reveals spatial environmental network relationships as well as it can serve as a retroactive mapping device for environmental catastrophe.

The current definition of territory as a spatial construct can be summarized as "the area over which a certain person, organization, institution, animal, state or country has control or possession."^{ixi} Within social geography, territory is often described in relation to a capitalist force of production. Henry Lefebvre, for example, critiques Marx understanding of space and territory as "only the sum of the sites of production, as the territory of various markets"^{ixii} but nevertheless, Lefebvre engages in Marx' trinity of "Land-Capital-Labor" as main defining structures of territorial organization.^{ixiii} 'Mushroom discourse' opens up the possibility for a "layering" of the term territory and expanding on the idea of territory by adding "extra-territorial", "unwanted" forms of territory - such as Chernobyl's territory of pollution.

Mushrooms as large scale territorial systems

Contaminated mushrooms define a territory of pollution characterized by mutual radioactive contamination through radioactive fallout from the Chernobyl power plant. This new form of territory spans nation state boundaries, climatic zones as well as geographic differences. Mushrooms in the affected areas recorded the environmental and atmospheric effects of the disaster and encapsulated them within their fruiting bodies converting the territory of pollution into a 'recording device' for man made disaster.

Today, the territorial consequences of the catastrophe have long been forgotten in most parts of Europe. It can be said that, in the mind of the public, the environmental impacts of Chernobyl have been reduced to the Chernobyl Exclusion Zone (CEZ) in direct vicinity of the reactor.

The physical scale of the catastrophe remains unknown and uncertain, even scientific research tends to focus on small, local areas of contamination. In lieu of a missing larger picture there remains an overall "uncertainty" about the magnitude of the Chernobyl fallout, even though the subject has been extensively studied.^{ixiv}

Mapping the Chernobyl catastrophe

Contamination levels in mushrooms remain high and "the concentrations and transfer coefficients [...] show that there has been only a slow decrease in radiocaesium activity concentrations in most plants and animal foodstuffs during the past decade."^{ixv} It thus remains important to map radiocaesium levels in affected ecosystems as a means of visualizing the aftermath of the fallout.

Mushroom Discourse

Mushrooms remain amongst the most contaminated species and therefore qualify as an ecological mapping device for tracing the effects of the Chernobyl disaster 25 years after the reactor catastrophe: "Activities of ^{137}Cs , from nuclear weapons testing below 1000 Bq/kg dry matter were reported until 1985. The situation changed dramatically after the Chernobyl accident and activities up to tens of kBq/kg dry matter [...] were observed in the following years in some edible species." lxvi

The maps presented in this study are based on the mushroom data available and reveal different fallout levels on relatively adjacent sites. Mushroom radiation maps prove that distance from the site of the accident is not a reliable factor for determining radiation levels within foodstuffs, animals and ecosystems. lxvii

INTANGIBLE CATASTROPHE – INVISIBLE EXTERNALITIES

Chernobyl's (mainly invisible) externalities raise the question about other large scale externalities resulting from energy production. 'Mushroom discourse' shows that there are substantial large scale energy externalities from supposedly environmentally "clean technologies" such as nuclear energy. The Chernobyl fallout cloud revealed large network connections at the scale of a continent. Some of the environmental relationships and mechanisms at work are still unclear today. Together, the Chernobyl network of externalities forms an alternate man-made territory of pollution whose expanse is scientifically measurable by monitoring radiation levels in soil and mushrooms. This possibility of "making visible" of otherwise invisible network relationships is what sets the Chernobyl disaster apart from other (daily) environmental catastrophes.

In order to scientifically specify the intensity levels of pollution through the Chernobyl catastrophe, mushrooms are increasingly utilized as an environmental reference material for radionuclide measurements in environmental samples. lxviii This data can also be used to monitor and spatialize the effects of the Chernobyl catastrophe. Updated maps of the extents of pollution are necessary in order to understand the environmental consequences of Chernobyl caused radioactive contamination today.

Beyond the zone – networked pollution

The effects of the Chernobyl catastrophe extend far beyond the Chernobyl Exclusion Zone (CEZ). The examination of mushroom populations revealed a territory of pollution which follows environmental patterns and conditions as a result of interconnected large scale networks. The argument about the interconnectedness of ecologies has always been one of the main drivers of environmental movements advocating for a more careful handling of man-made influences and actions within the environment. In "Toxic Discourse", Lawrence Buell describes a "regained urgency" in the discourse about toxicity in order to "challenge traditional understandings of the environmental movement and environmental representation generally." lxix

Buell quotes Rachel Carson who pictures that "for the first time in the history of the world, every human being is now subjected to contact with dangerous chemicals, from

Figure 13: Paradox 01
- Thirty kilometers of
exclusion?

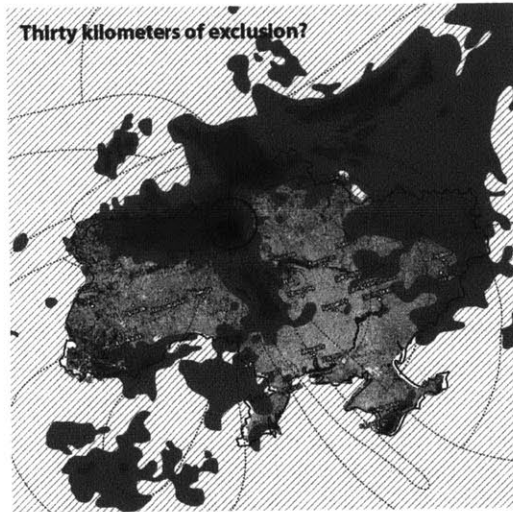
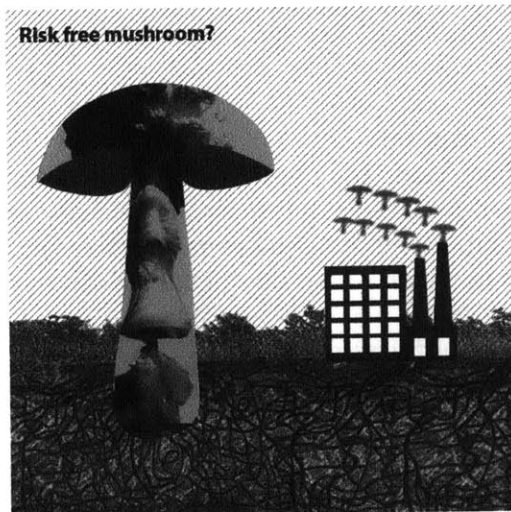


Figure 14: Paradox 02 -
Bidirectional Exodus?



Figure 15: Paradox 03 -
Risk Free Mushroom?



Mushroom Discourse

the moment of conception until death.”^{lxx} The age old distinction between nature and society is effectively nullified in a culture which “produces” its environment in forms of technological, political and nature(s) hybrids (see Latour 1993, 2004).^{lxxi} Mapping networked pollution through mushroom contamination becomes a means of tracing such produced hybrid natures and finding better ways to understand the effects of this “production of nature” onto society. Networks of pollution have long become cultural artifacts or drivers for significant social changes – especially in relation to the environmental movement – but their spatial implications remain underrepresented.

Environmental catastrophe – for whom?

The IAEA states that within sites which have been abandoned by human population, “significant population increases of game mammals (wild boar, roe deer, red deer, elk, wolves, foxes, hares, beavers) and bird species were observed soon after the Chernobyl accident.”^{lxxii} In fact, large parts of the CEZ have become a (contaminated) wildlife reserve in the last 25 years. For large parts of the CEZ contamination will make any return of non-temporal human inhabitation impossible for hundreds of years to come.

Chernobyl has produced many paradoxes such as the return of wildlife and nature into a “unnatural”, and dangerous environment. It’s externalities remain intangible and even though there have been hundreds of scientific publications on the topic, the catastrophe remains highly controversial. Nevertheless, the Chernobyl catastrophe has raised - and continues to raise - awareness about other energy related externalities while serving as a catalyst for environmental debate.

Five paradoxes

Chernobyl’s contribution to the discourse about environment can be summarized by analyzing some of the catastrophe’s inherent paradoxes:

01 Thirty kilometers of exclusion – certified territory of pollution?

While the site of the accident is clearly marked by a 30 km exclusion zone, it’s effective impact on the environment happens on a much larger scale. In fact, Chernobyl has produced a multiplicity of sites and polluted territories. The analysis of mushroom populations has reveals large environmental cycles and their relation to transmission of contamination.

02 Toxic nature – natural refuge?

The discourse about toxicity raises the question about the evaluation of energy externalities. The (almost heretical) question if toxicity can result in positive externalities has to be brought up within a society that produces its own nature and nature-hybrids. Can nature be saved through pollution within sites of human exodus?

03 Natural mushroom – healthy mushroom?

‘Risk Society’ has produced natural products such as forest mushrooms which have been ‘denaturalized’ through excessive pollution. Today, the pure, clean and safe mushroom comes from the mushroom factory.

Towards the Anthropocene . Sasa Zivkovic . MArch . MIT
Mushroom Discourse

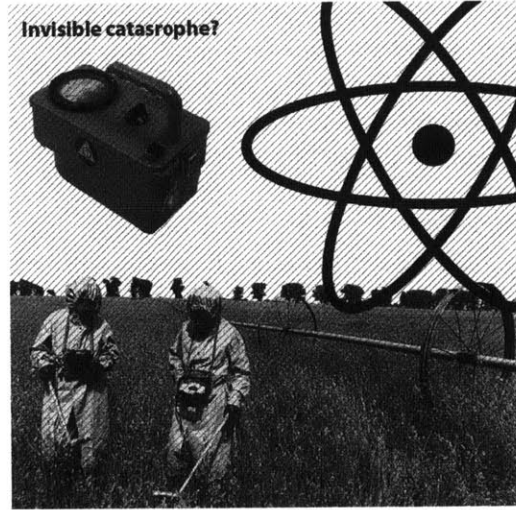


Figure 16: Paradox 04 - Invisible catastrophe?

Figure 17: Paradox 05 - Natural at last?



Mushroom Discourse

04 Invisible radionuclide – visible nuclear catastrophe?

The invisibility of radionuclides as the main source of contamination renders this catastrophe socially dangerous and environmentally severe. At the same time the rather easy scientific detectability of radiation is a prerequisite for revealing large scale horizontal and small scale vertical relationships within environments and ecologies.

05 Catastrophe – natural at last?

In an attack on a romantic reading of nature as a harmonic entity, Slavoj Žižek points out that “nature is a series of mega catastrophes” and “nature, in the sense of a harmonious nature is ‘dead’”.^{lxxiii} Maybe the polluted, animal paradise of the CEZ challenges the common ideology of pristine nature-ecology after all?

CONCLUSION

Analyzing mushroom populations affected by the Chernobyl catastrophe allows for a re-evaluation of large scale energy externalities resulting from environmental catastrophe. The use of a biological indicator for visualizing nuclear contamination can help to uncover large and small scale environmental correlations as well as social and economic relationships forming around the discourse of toxicity.

Large scale externalities associated with the Chernobyl catastrophe have been downplayed by governments, media and the public. We live in, eat from, and are constantly surrounded by territories of pollution, but, due to their intangibility, such territories of pollution often remain abstract concepts and constructs. The measurable radioactive contamination in mushroom populations is a means of uncovering the severe socio-economic and ecological effects resulting from energy externalities. Conclusions for other, less measurable sources of pollution can be drawn from this study.

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Figure 2:<http://oolaaah.com/?p=18046> (accessed, July 23, 2011)

Figure 3: <http://thelvetrocket.files.wordpress.com/2009/09/pripyat18.jpg?w=500&h=375> (accessed, July 23, 2011)

Figure 4:Diagram by the author (Data from: UN Chernobyl Forum. Environmental Consequences of the Chernobyl Accident and Their Remediation: Twenty Years of Experience / Report of the UN Chernobyl Forum Expert Group “Environment” (EGE). 2005. pp. 30)

Figure 5:Diagram by the author

Figure 6: <http://www.chernobylee.com/images/LiqR3.jpg.pagespeed.ce.R7NH4fC6l6.jpg> (accessed, July 23, 2011)

Figure 7:Diagram by the author

Figure 8:Diagram by the author

Figure 9: Diagram by the author

Figure 10: Diagram by the author (Data from: UNEP/GRID-Arendal, European Environment Agency; AMAP Assessment Report: Arctic Pollution Issues, Arctic Monitoring Assessment Programme (AMAP), 1998, Oslo; European Monitoring and Evaluation Programme (EMEP);

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Figure 12: Image from: IAEA. Environmental Consequences of the Chernobyl Accident and their Remediation: Twenty Years of Experience. Report of the Chernobyl Forum Expert Group ‘Environment’. (Vienna,

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Figure 13:Diagram by the author

Figure 14:Diagram by the author

Figure 15:Diagram by the author

Figure 16:Diagram by the author

Figure 17:Diagram by the author

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Mushroom Discourse



The arrow of time

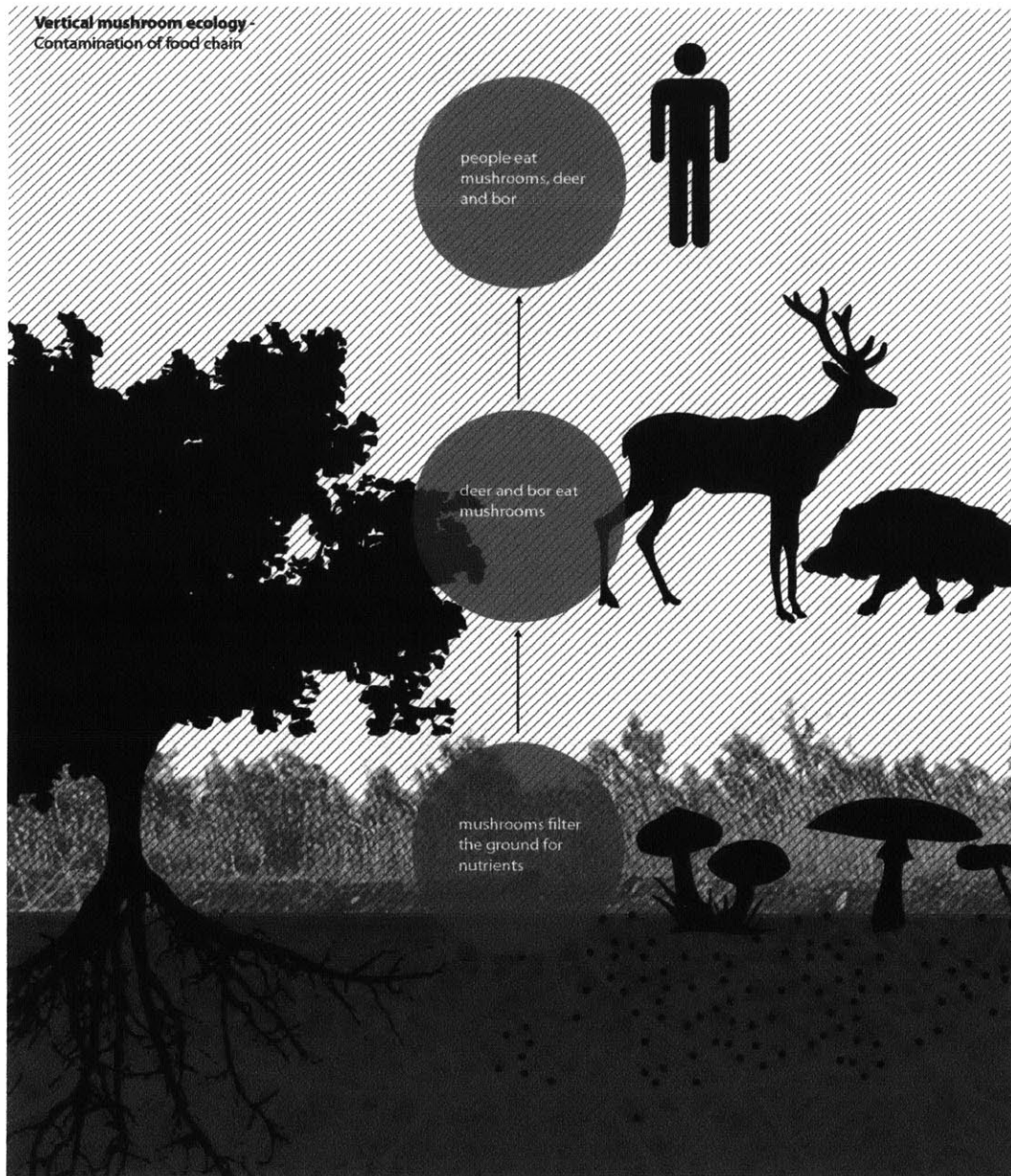
"Could I have imagined, forty years ago, that the Apollo missions were not leading toward outer space, but, on the contrary, would soon backfire and lead our attention to inner space? I mean the space of the Blue Planet that astronauts were filming with such rapt precision. We have learned in the meantime that space is contested territory. It is hard to imagine that in such a short span of life the "arrow of time" too has so thoroughly changed its shape and direction. It is not an arrow anymore, targeting some well-accepted goal. It is rather like a plate of spaghetti, zigzagging around without leading in one direction, to one climax [...]"

Latour, Bruno. *Forty Years Later – Back to a Sub-lunar Earth. Ecological Urbanism*. Harvard University Graduate School of Design. (Baden, Switzerland: Lars Mueller Publishers 2010)

The arrow of time

By the mid 1970's, global environmental conscience emerges in many countries resulting in new environmental legislation, ministries of environment and the founding of green parties. Bruno Latour describes this as the moment in history in which the "arrow of time" points from an overarching technological project (Latour refers to the Apollo missions) to something which "is not an arrow anymore, targeting a well-accepted goal. It is rather like a plate of spaghetti, zigzagging around without leading in one direction, to one climax [...]"^{xiii} Interest shifts from nuclear energy utopias to health concerns of people living in the vicinity of power plants, the effects of excess heat water on river ecosystems, adequate locations for storing nuclear waste, or in case of this study, the implications of 137 CS mushroom contamination in forests ecosystems across Europe.

Mushroom Discourse



Mushroom filters

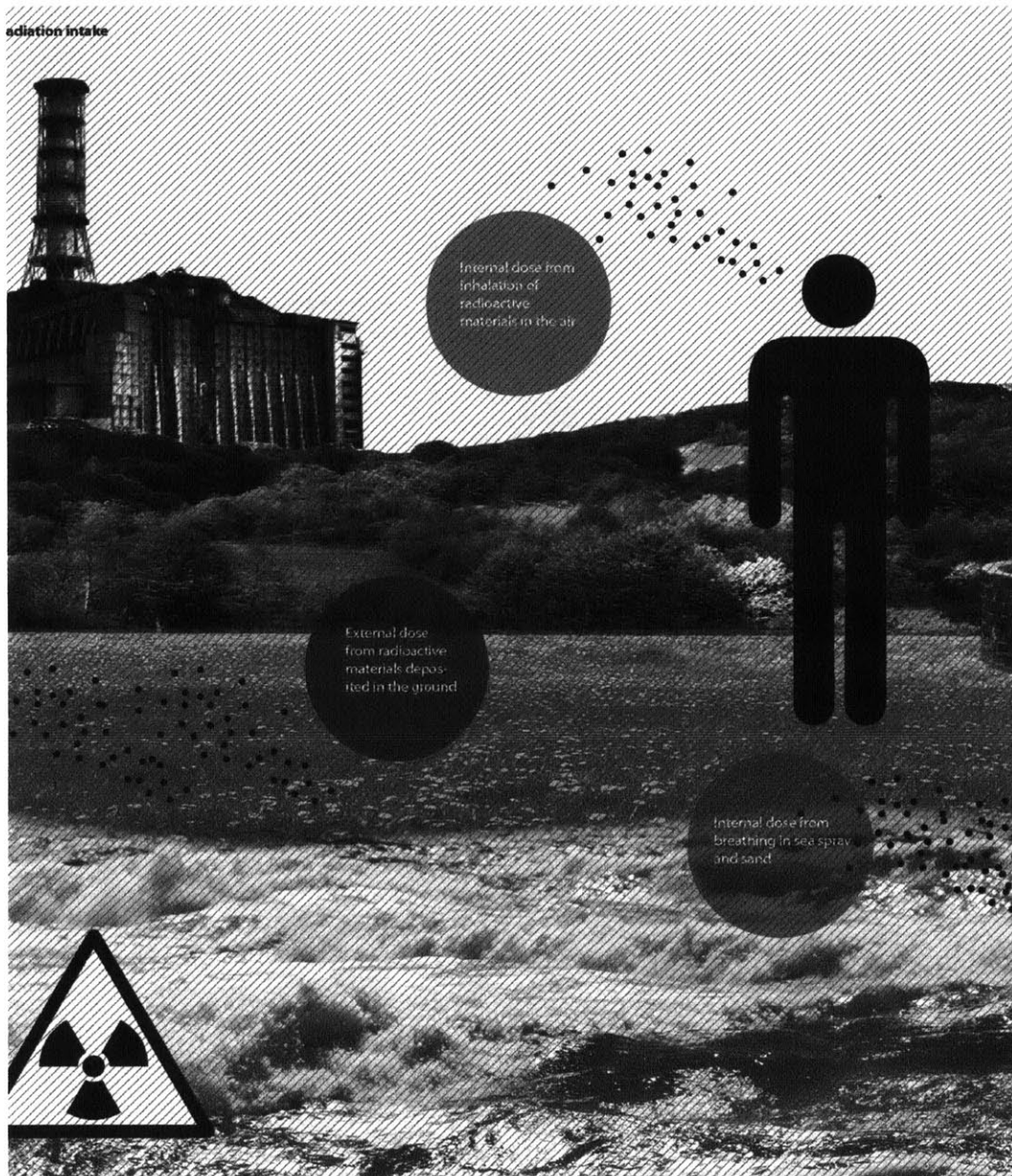
Mushrooms are the fleshy spore bodies of fungi and form their own kingdom of eukaryotic organisms. They are neither plants, animals, nor bacteria. Fungi occur in almost every environment on Earth and play an important role in balancing ecosystems. Along with other organisms such as bacteria, fungi play a critical role in decomposing organic matter and additionally play an essential role in nutrient cycling.^{xlv}



Continental traces: meteorology in April and May 1986

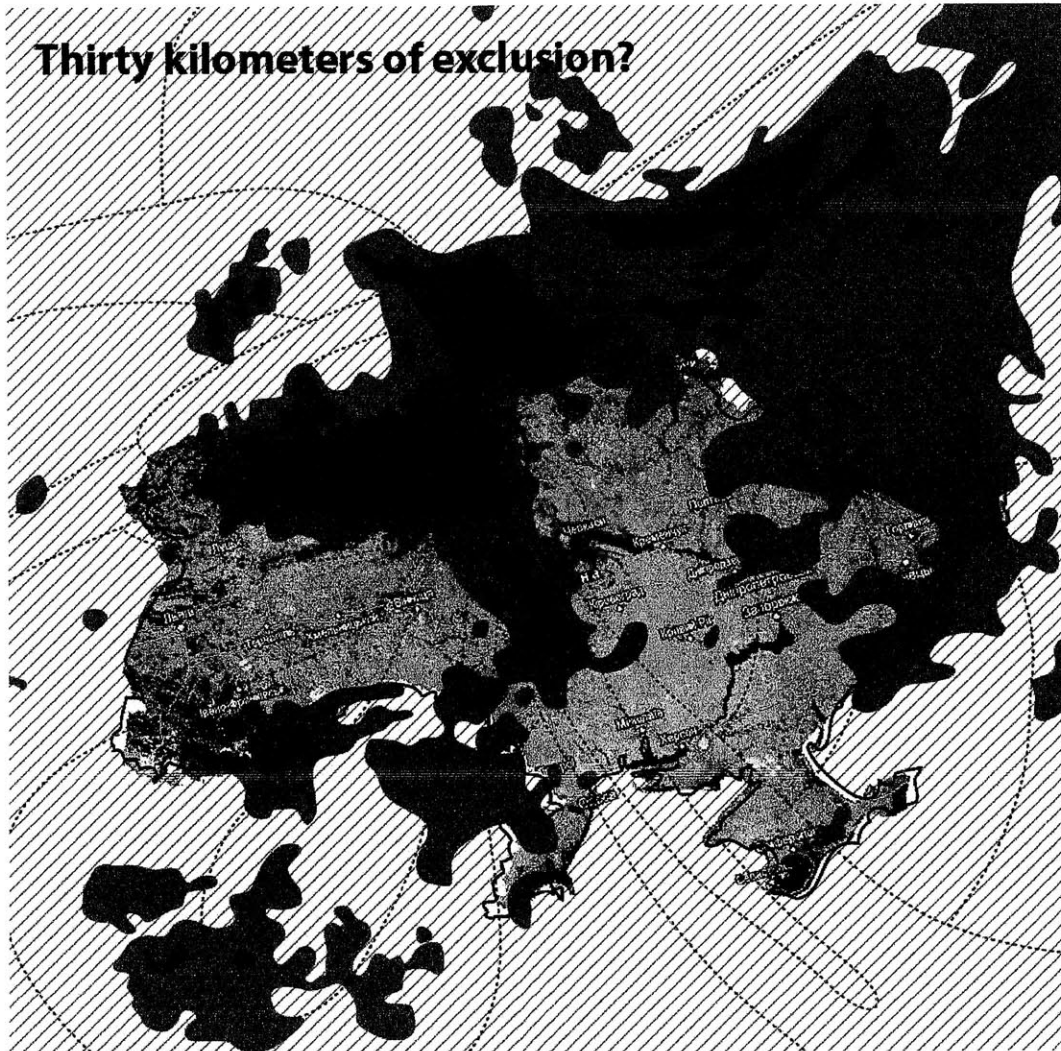
First traces of the explosion in reactor number IV of the Chernobyl power plant outside the USSR were found on April 28 in the clothing of a technician at the Forsmark nuclear power plant in Sweden.xxvi Due to the alarmingly high levels of radiation it was first suspected that leakage had occurred within the reactor in Forsmark itself. Later that day, the same distressing signals came from reactors and control stations in Norway, Finland and Denmark. At this point, Sweden confirmed that the source of radiation had to be outside the country.

Mushroom Discourse



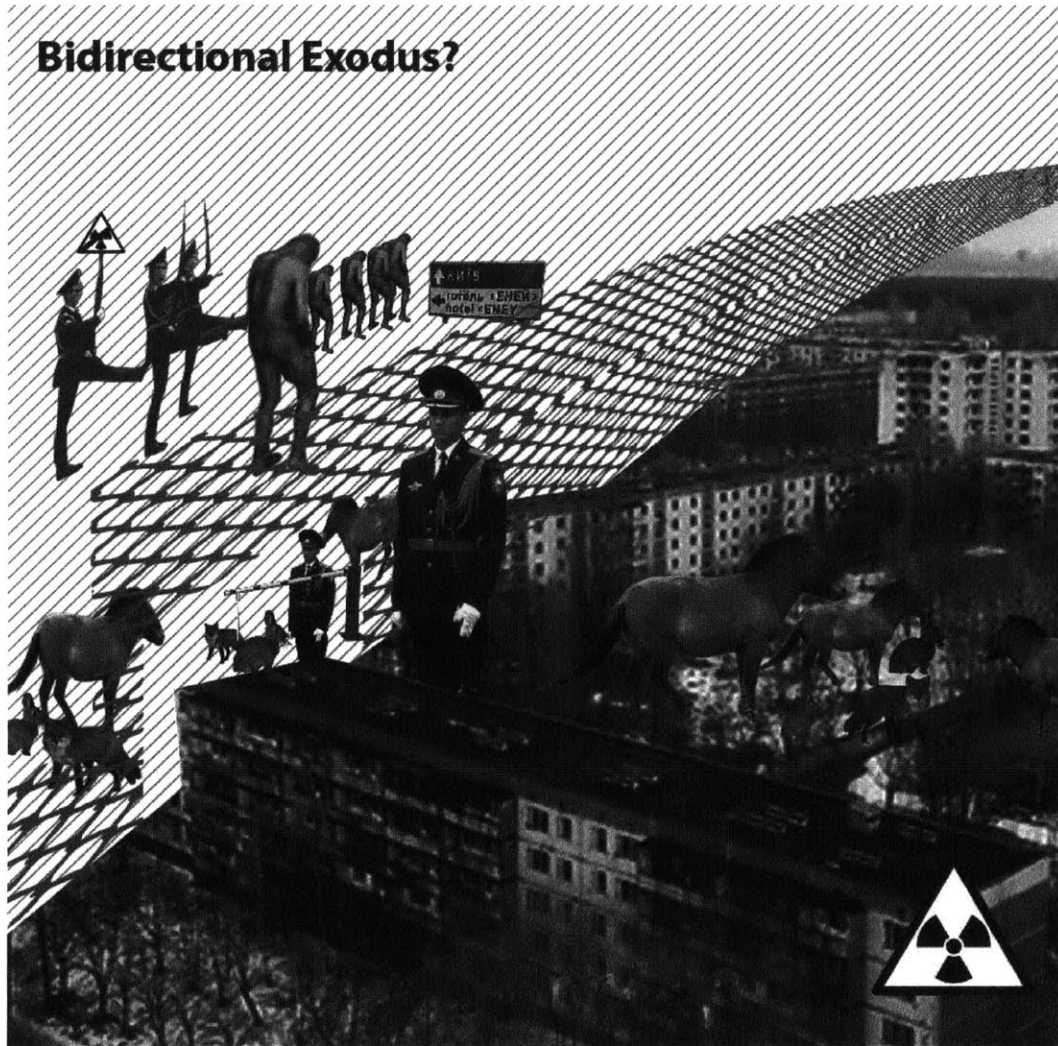
Measuring contamination – nuclear externalities

The IAEA guideline and dose limit for radiation from any man made facility is 1 mSv per year. (reference values: chest CT scan: 6–18 mSv per scan / New York-Tokyo flights for airline crew over one year: 9 mSv).xxxiv Evaluating radioactive contamination is complex because all measurements include a temporal component which effectively determines the radiation hazard for living organisms. In other words, short exposure to a high dose of radiation might be less harmful than low exposure over a longer period of time.



01 Thirty kilometers of exclusion – certified territory of pollution?

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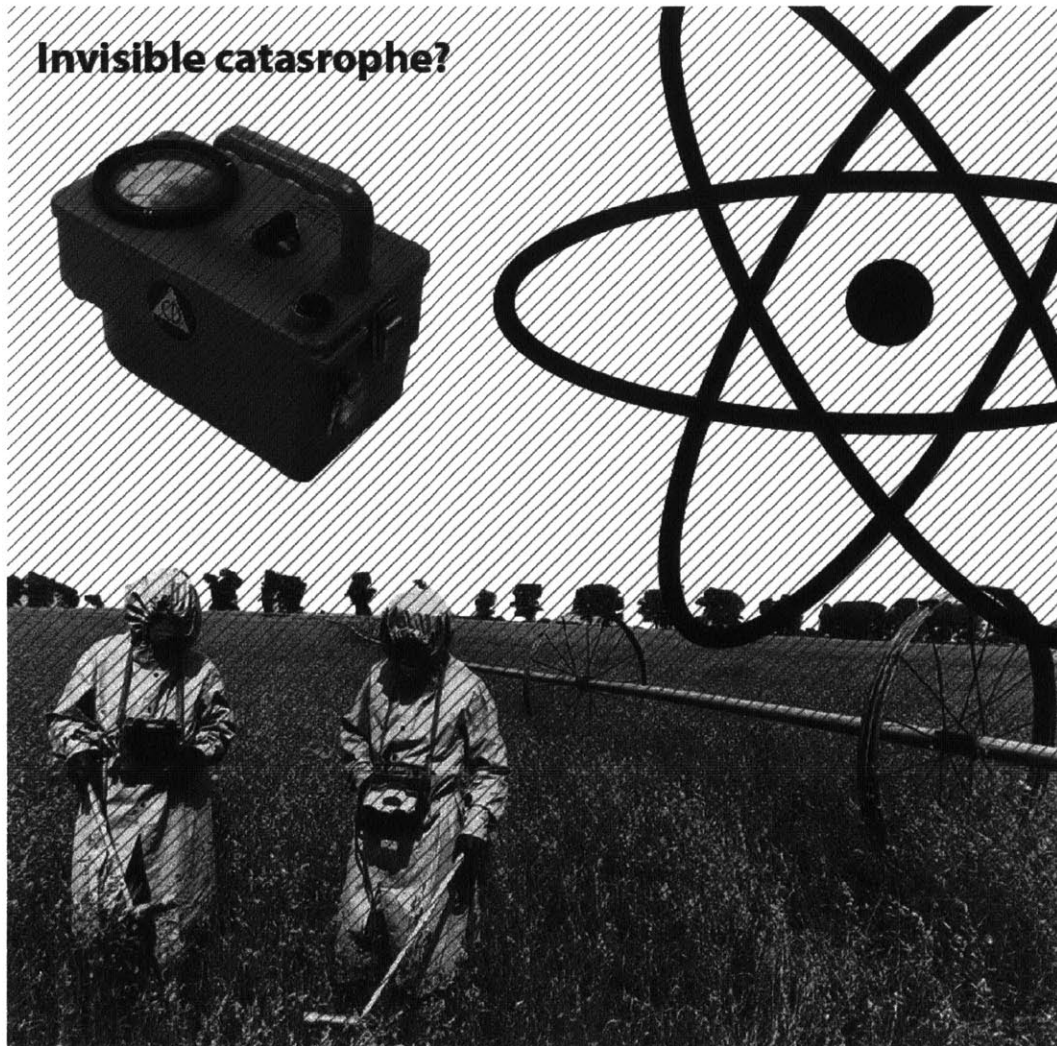
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The invisibility of radionuclides as the main source of contamination renders this catastrophe socially dangerous and environmentally severe. At the same time the rather easy scientific detectability of radiation is a prerequisite for revealing large scale horizontal and small scale vertical relationships within environments and ecologies.



05 Catastrophe – natural at last?

In an attack on a romantic reading of nature as a harmonic entity, Slavoj Žižek points out that “nature is a series of mega catastrophes” and “nature, in the sense of a harmonious nature is ‘dead’ ”.lxxiii Maybe the polluted, animal paradise of the CEZ challenges the common ideology of pristine nature-ecology after all?

Chernobyl mushroom contamination in Europe
All values in kBq / kg wild mushrooms

Radiation limit for foodstuffs: 1.25 kBq per kilogram
(before Chernobyl: 0.6 kBq per kilogram)

AA

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BB (Bavaria, Schoengeising near Munich)

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CC (Sweden, Heby near Stockholm)

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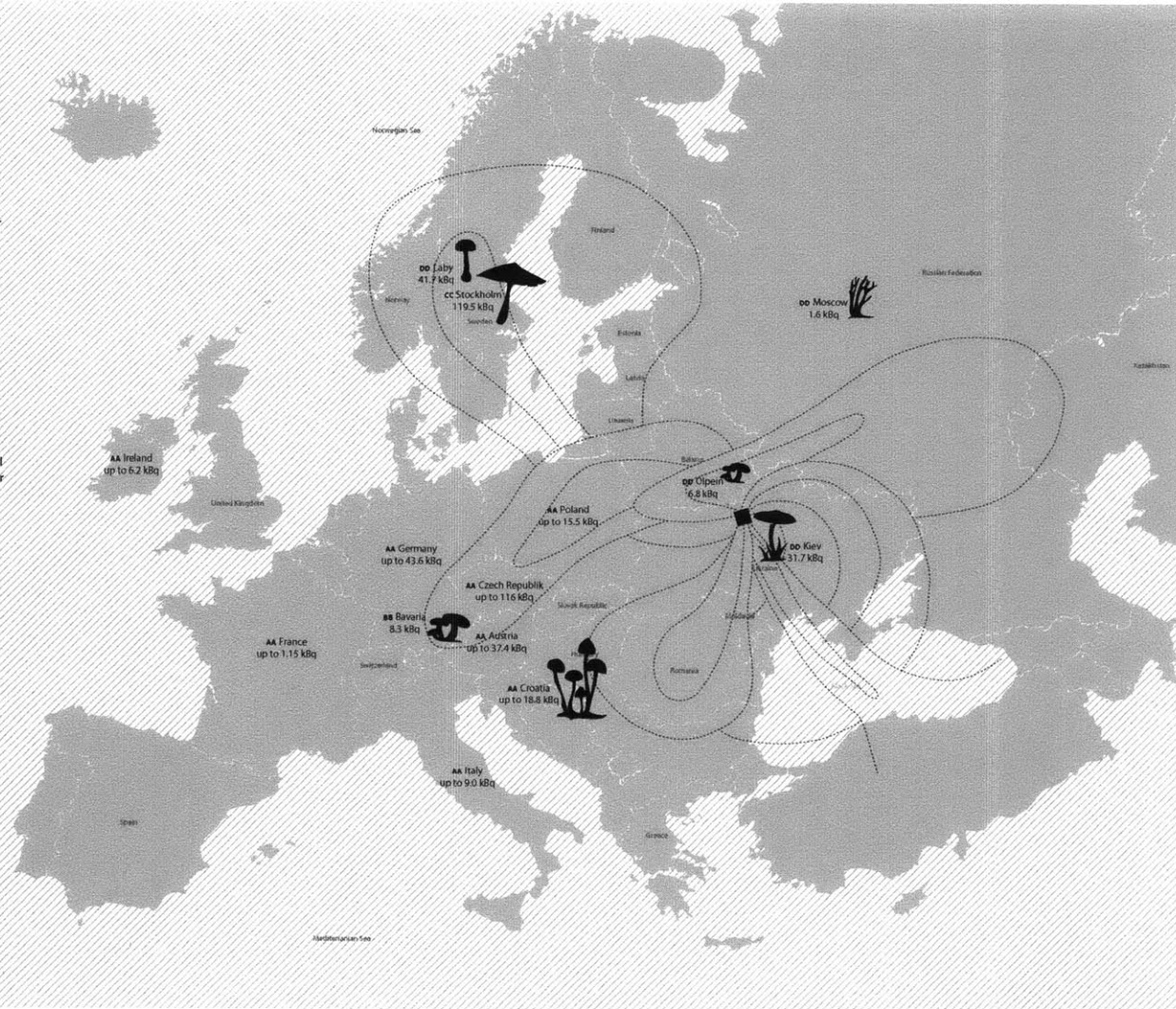
DD

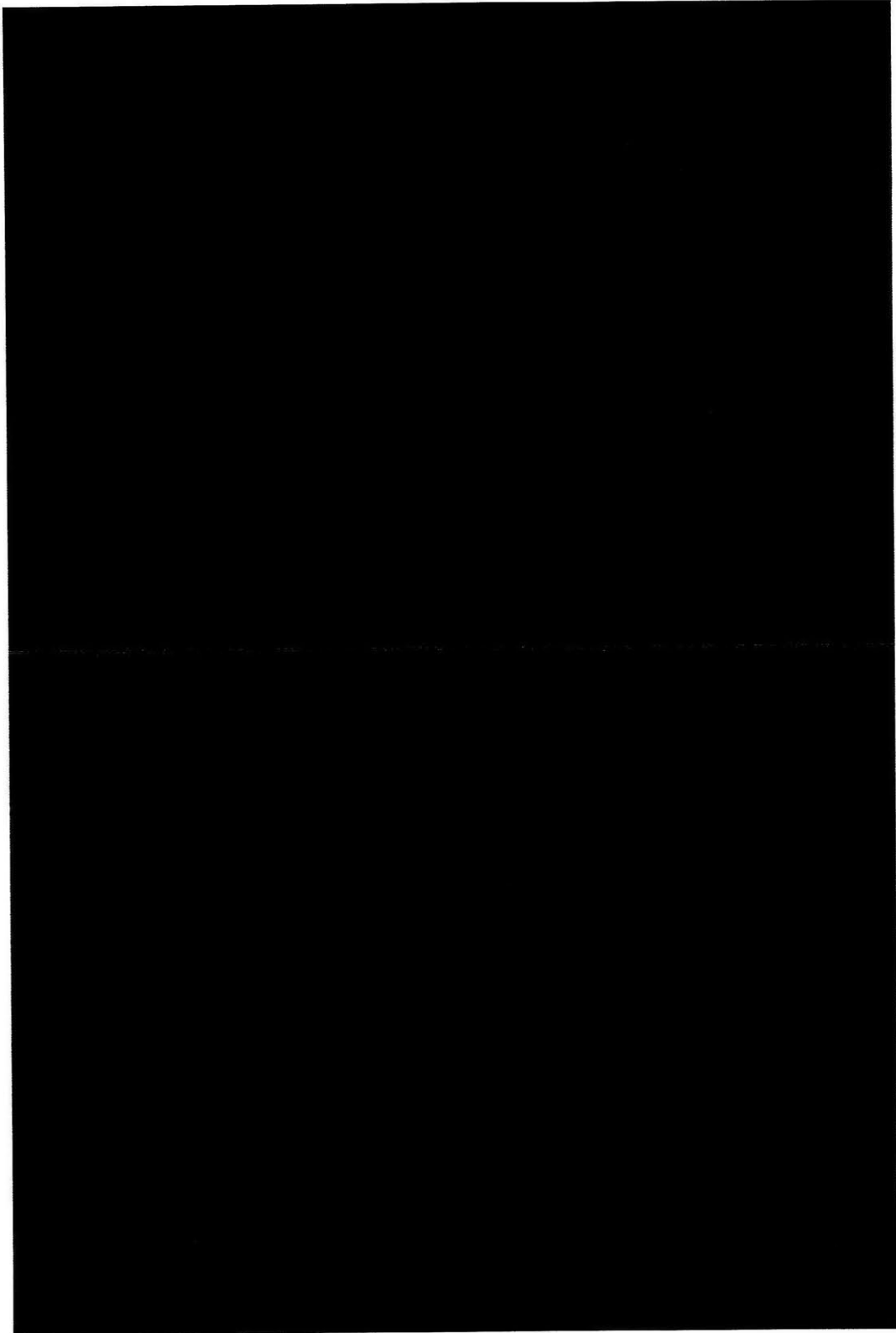
M. L. Smith et al. Comparison of the Post-Chernobyl ¹³⁷Cs Contamination of Mushrooms from Eastern Europe, Sweden, and North America. Applied and Environmental Microbiology, Jan. 1999, p. 134-139. American Society for Microbiology

oo Ontario
0.9 kBq

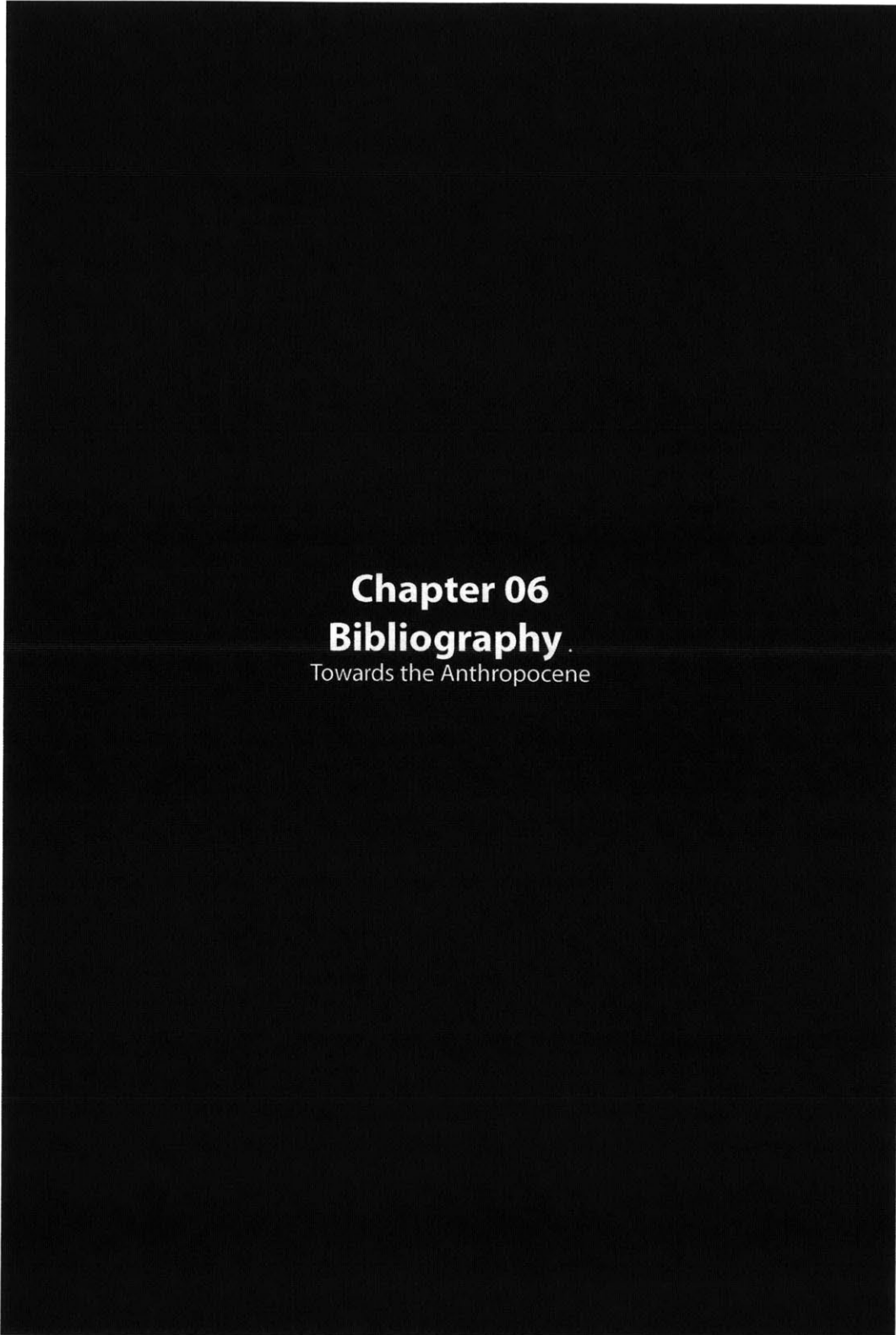
oo Michigan
0.05 kBq

AA Japan
1.1 kBq





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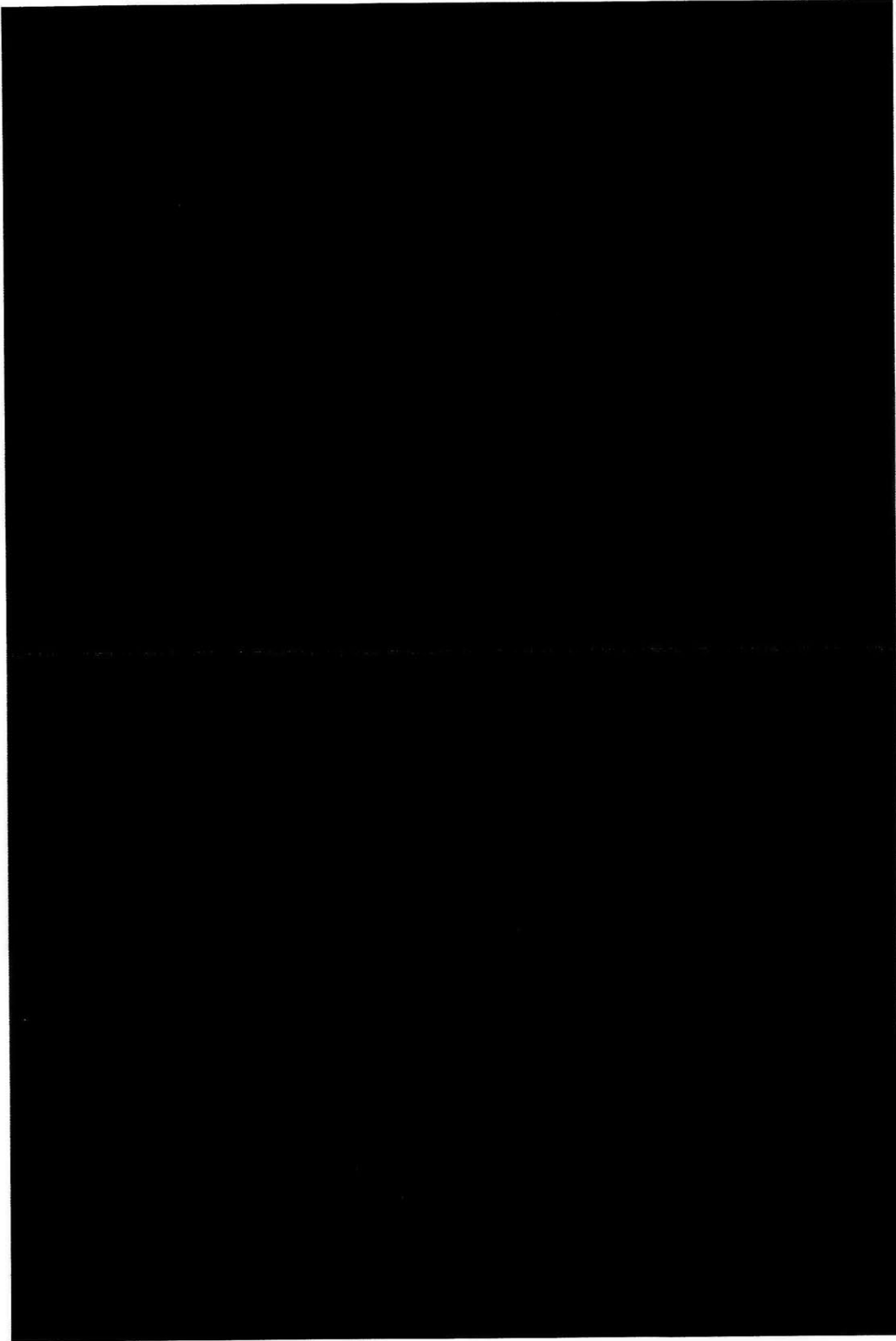
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